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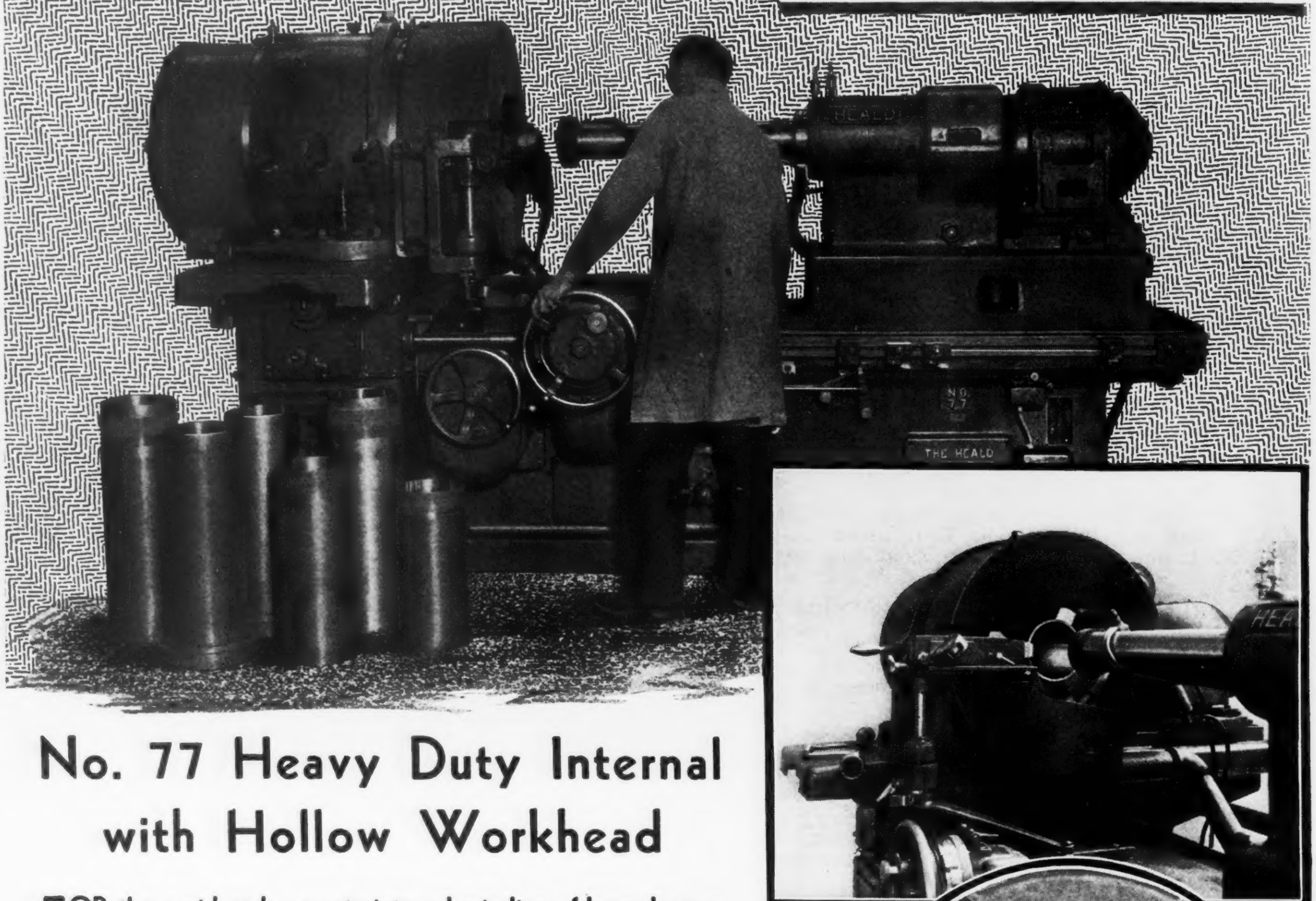

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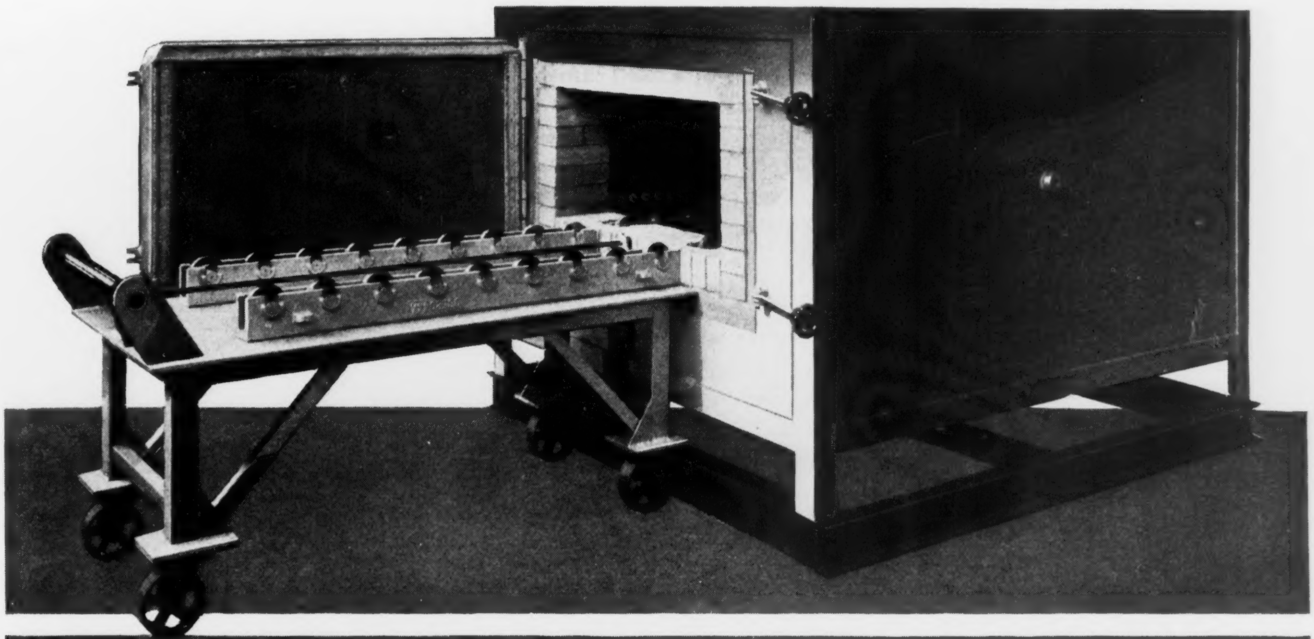


What Is Nitriding? How Is It Done

By J. H. CATES, Jr.,
Industrial Heating Department
General Electric Co.

Every wide-awake executive in the machine-building field is constantly on the lookout for means of improving the quality and lengthening the life of his product. Thus the nitriding process has created widespread interest among executives in this field who want to know just what this process will accomplish in prolonging the life of metal surfaces that are subject to wear. To answer this question, three executives interested in entirely different products conducted practical tests, the results of which are given in the following paragraphs.

One executive found that when the cylinders in his motor blocks were nitrided the wear was reduced in the ratio of 20 to 1. The test made in this case showed that the wear on the untreated cylinders after the car had traveled 18,630 miles was 0.016 inch, whereas the nitrided cylinders showed only 0.0008 inch wear.

Another executive found that nitrided reamers used on hard rubber would do twice as much work with half as much regrinding as the ordinary heat-treated steel reamers. Still another executive found that nitrided

While several articles have been published on the subject of nitriding during the last two years, the editor's mail frequently brings letters asking the question: "What is nitriding, and how is it done?" It is evident that a great number of the men responsible for the quality and quantity of the output in the machine industries eagerly look for information on this process and its uses. The object of this article is to present such information in concise form. The author outlines the results obtained by the nitriding process, covers briefly the general principles on which it is based, and describes the furnaces and auxiliary equipment that is used in its application.

valves were the only satisfactory solution to the problem of providing valves for a turbine that would resist the action of live steam and show a high degree of wear resistance at high temperatures. These examples are typical of the many fields in which this process is now being applied.

What Constitutes Nitriding?

Briefly, nitriding consists of heating articles made of certain alloy steels containing aluminum, chromium, molybdenum, etc., in a retort of ammonia gas at a temperature of from 900 to 1200 degrees F. for a period of from two to ninety hours at various gas pressures. Steels thus treated possess many novel and useful characteristics, the most important of which is extreme hardness of the case. A hardness of around 1000 Brinell as compared with about 650 for the best carburized steels is obtained.

The hard surfaces obtained by nitriding seem to be due to the formation of nitrides of the iron and alloying agents in the steel along the slip planes. In the presence of heat, ammonia gas decomposes to a certain extent according to the equation,

$$2NH_3 = 2N + 3H_2$$

At the moment of decomposition the nitrogen is in a nascent state and reacts readily upon the steel with which it comes in contact, forming the nitrides mentioned. It should also be mentioned that the free hydrogen liberated during this reaction has a high affinity for carbon, and if there is too much hydrogen present, enough carbon will be removed from the surface of the steel to leave it brittle, allowing the nitrided section to flake off or "spall." This action will be considered further in the description of the nitriding equipment.

Characteristics of Nitrided Work

Photomicrographs and taper-ground test samples of nitrided steel show that the hardness decreases gradually as the distance from the surface increases until the case finally merges imperceptibly into the core of the test piece. There is no sign of "framing" which is typical of carburized steels. Owing to this gradual merging of the case, the cores of nitrided steel parts are tough and show high impact-resisting properties.

One of the greatest disadvantages of casehardening by carburizing is that the parts warp under the influence of the high temperatures involved. One manufacturer of small machines found that his 8-inch carburized crankshafts warped to such an extent that they were from 1/32 to 1/8 inch out of alignment at the center. In this case, a spot-annealing machine for heating the center of the shafts and a straightening jig were required to straighten the shafts. This difficulty, with the added cost for extra treatment, could have been eliminated by nitriding. Since the temperature required in nitriding is never above 1200 degrees F., and usually around 900 to 1000 degrees F., there is no tendency for the parts to warp. Hence, no special operations are required after nitriding.

Nitrided articles are a dull gray when they come from the furnace, having somewhat the appearance of nickel-plated articles fresh from the plating bath. This gray sheen may be changed to a very high mirror-like polish by applying a buffer for a

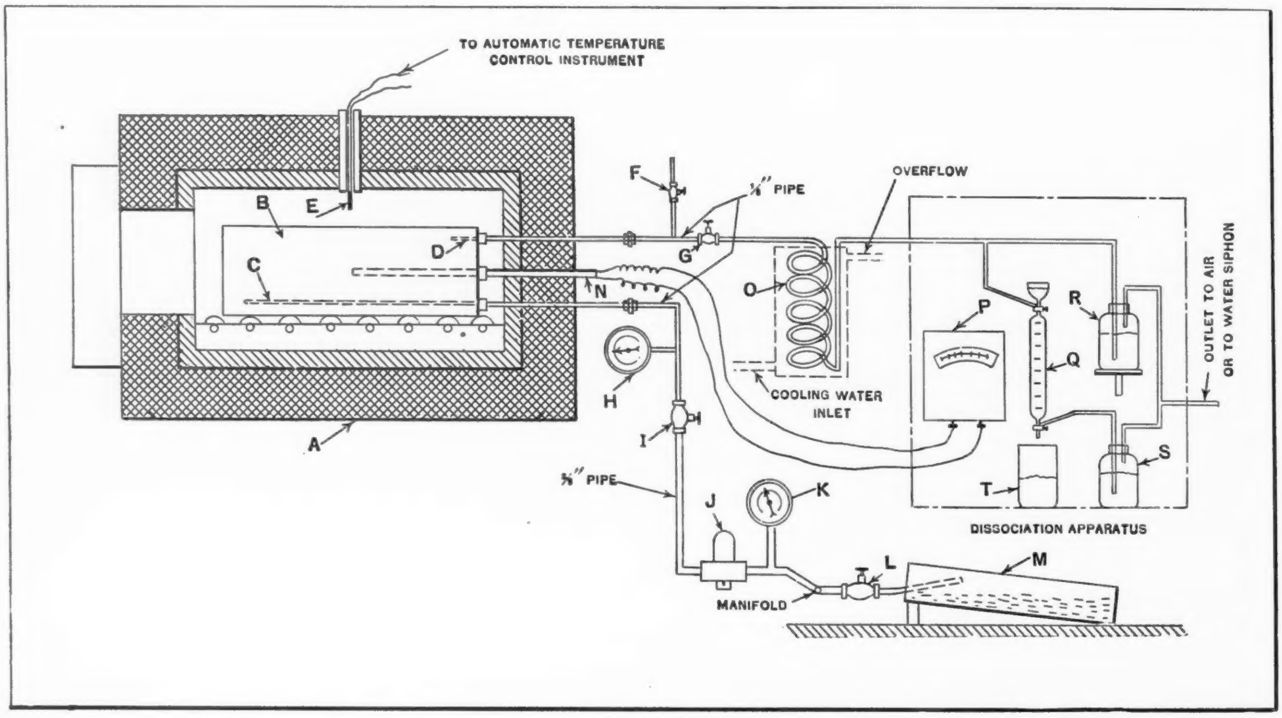
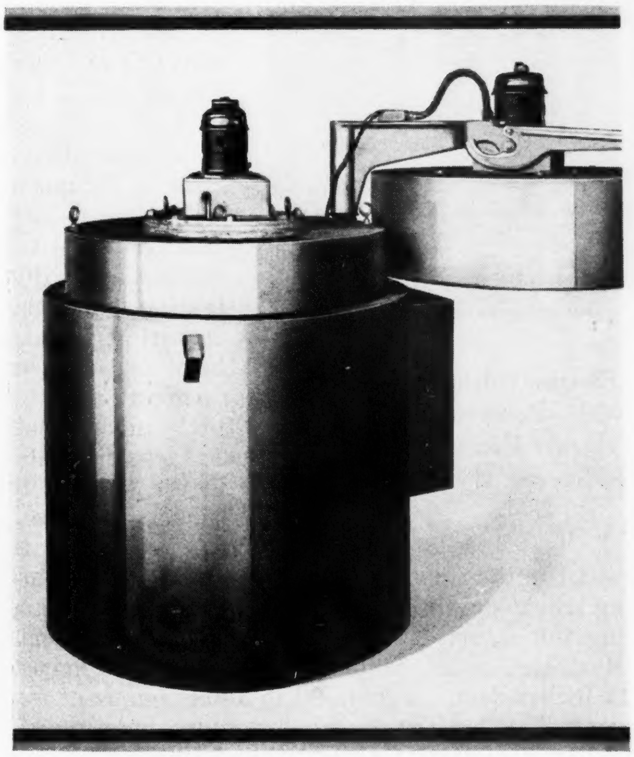


Fig. 1. Diagram Showing Arrangement of Furnace, Dissociation Apparatus, Ammonia Drums, Cooling Coils, and Auxiliary Equipment Used in Nitriding

few moments. Experience has proved, however, that higher resistance to corrosion is exhibited by the unpolished surface. For this reason, it is preferable to use the nitrided articles just as they come from the furnace. In this state, they are practically rustless, being quite similar to stainless steel in this respect. They are unaffected by rain, snow, ice, salt water, steam, oils, alkalies, or gasoline. In the case of acids, however, they show comparatively little resistance.

An important characteristic of nitrided steel is its ability to hold its hardness at high temperatures. Ordinary steel seldom remains hard after undergoing temperatures of 350 to 400 degrees F. Nitrided steel, however, remains file-hard up to a temperature of 1200 degrees F., and is therefore ideal for applications requiring high wear-resistance at comparatively high temperature, as in the case of valves, pistons, piston-pins of automobiles, steam turbine parts, etc. Nitriding is also an ideal method of treating dies that may be called upon to operate at almost a red heat.

Fig. 2. Combination Electric Furnace with Ring Cover and Nitriding Retort in Place and the Cover Used for Air Drawing Swung to One Side



Growth of Nitrided Parts

One peculiar effect noted in nitriding is the tendency of the work to "grow" in size due to the actual combination of the nitrogen with the elements in the steel. On solid sections this growth may amount to from 0.001 to 0.003 inch on the diameter, depending on the length of the nitriding period. The increase in size is regular, however, and allowances for this growth can be made in the machining operation prior to nitriding. If this growth is not too great, the parts may be lapped in place after nitriding.

Equipment Required for Nitriding

The apparatus or equipment required for nitriding is shown diagrammatically in Fig. 1. The retort *B*, shown inserted in the furnace *A*, should be of special alloy steel, such as KA-2 or NCT-3, to resist the action of the ammonia gas (NH_3). Alloy steel or pure nickel tubing should be used for the gas inlet and outlet pipes and for the protection of the thermo-couple *N*. At least two ammonia drums *M* should be used to insure a continuous supply of ammonia gas and to prevent air from leaking into the retort while changing drums. The drum should be placed so that the outlet tube extends above the liquid, as shown, in order to make certain that the ammonia gas and not the liquid will pass to the furnace. Safety valves are included in the exit line from the furnace to by-pass the gas should leaks occur in the dissociation apparatus. Cooling coils surrounded by circulating water are provided to lower the temperature of the gas as it leaves the furnace and protect the dissociation measuring apparatus.

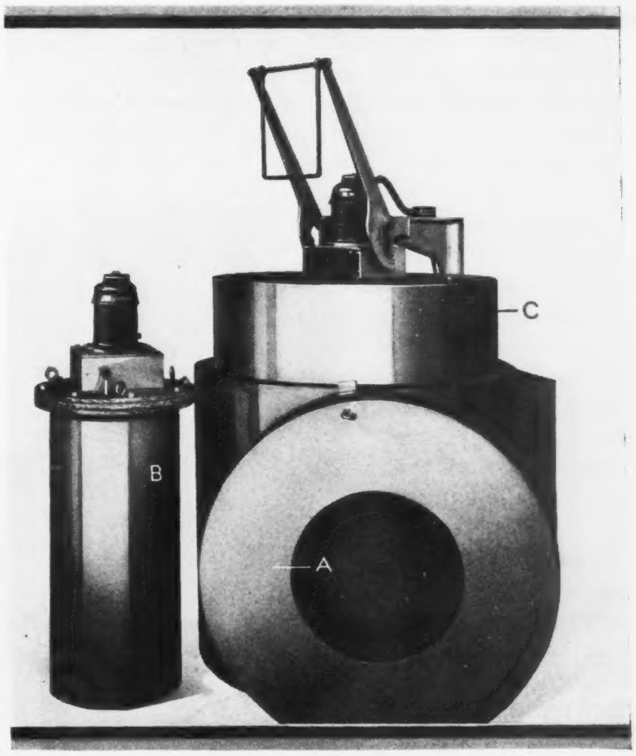


Fig. 3. Furnace Shown in Fig. 2 with the Ring Cover and Retort Used in Nitriding Removed and the Air-drawing Cover in Place

It was mentioned previously that the ammonia gas tends to break down in the presence of heat and that this decomposition must not be carried to too high a degree or the hydrogen liberated will remove carbon from the surface of the steel, causing flaking and brittleness. Hence, there must be some means of measuring the amount of dissociation of the ammonia. This is accomplished by the apparatus shown enclosed by dot-and-dash lines at the right in Fig. 1. Advantage is taken of the fact that the ammonia gas is readily soluble in water and that the nitrogen and hydrogen are insoluble at ordinary temperatures and pressures. The pipette shown at Q has a capacity of 100 cubic centimeters, and is provided with three-way cocks at the top and bottom and with a water receptacle at the top as shown.

When the two stop-cocks are open, dissociated gas will flow through the retort, and when both stop-cocks are closed simultaneously, 100 cubic centimeters of the gas will be caught in the pipette Q. When the upper stop-cock of the pipette is opened, the water in the receptacle at the upper end will flow gradually into the lower part. This water will flow as long as there is any ammonia to be absorbed in the pipette. Let us assume that the water rises to the 75 cubic centimeter graduation on the pipette. This means that 75 per cent of the gas leaving the furnace is undissociated ammonia and 25 per cent is composed of a mixture of nitrogen and hydrogen. This dissociation should never be allowed to be more than 30 to 40 per cent because of the decarburizing action of the excess hydrogen, as previously mentioned.

Dissociation varies with the flow. Hence dissociation is controlled by means of the needle valve I. The reducing valve J is provided to insure constant pressure at the needle valve, regardless of the pressure in the ammonia drum. This makes it easier to control the dissociation. It will be found that the dissociation varies widely while the charge is being heated up to furnace temperature, and the amount of dissociation should be checked frequently during this period.

Any type of furnace may be used for nitriding. The electric furnace, however, is especially well suited for this work. The nitriding process may be carried on within a wide range of temperatures, but the temperature used has a marked effect on the hardness. Nitriding at the lower temperatures produces a fairly thin but very hard case, while higher temperatures produce a deeper but softer case, as will be explained in a later article.

For the duplication of results in quantity production work, the operator should have accurate control of the temperature. Accurate temperature control also makes it much easier to hold the dissociation constant. Furthermore, nitriding is essentially a heat-holding process, so far as the furnace is concerned, so that for the greater part of the time only enough heat need be supplied to replace that lost through radiation. Electricity provides an economical source of heat for this purpose. The heating losses are low when electricity is used and the uniform temperature maintained results in uniform work. Cleanliness and ease of control are also features of electric furnaces.

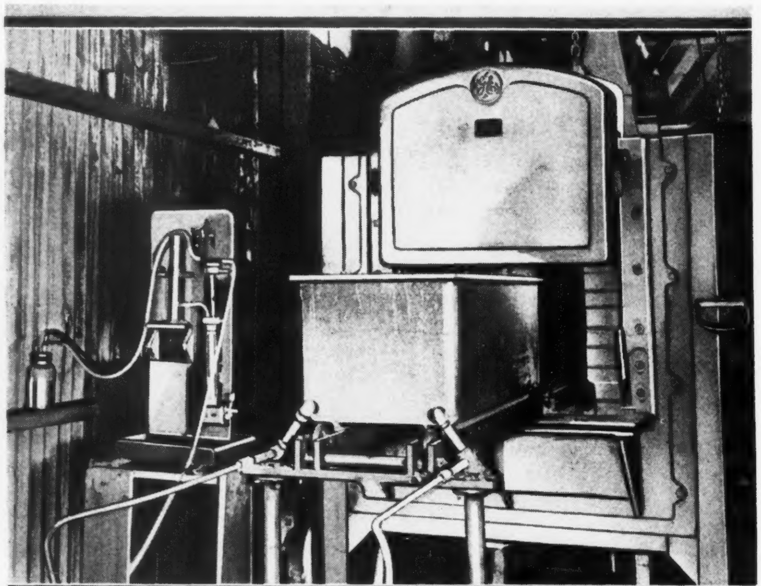


Fig. 4. A Box-type Electric Nitriding Furnace Equipped with Removable Racks and Rollers to Facilitate Handling the Retorts

The box-type furnace shown in the heading illustration is compact, requiring little head room and comparatively little floor space. A rack and rollers in the floor of the furnace make it easy to insert the retort in the furnace or remove it. A sturdy charging truck equipped with rollers also assists in handling the retort. The retort space in the furnace illustrated is 28 inches wide by 48 inches long by 11 inches deep. From 500 to 1000 pounds of steel can be handled per charge, depending upon the size and kind of work. This type of furnace is available in several sizes.

One of the latest developments in nitriding is the use of an agitating fan to produce positive circulation of the gas and insure quick discharge of the excess hydrogen. The fan also speeds up the heating of the charge.

A furnace of the type shown in Fig. 2 is composed of three parts—a shell containing the heating elements, a ring cover, and a nitriding retort. This retort is made in two parts. The upper part contains a fan and a fan motor, inlet and outlet

pipes for the gas, a thermo-couple protection tube, and a gas-tight packing gland for the fan shaft.

The lower half of the retort contains a basket which, in turn, contains the charge to be heated. This half also acts as a guide for the circulation of the gas. All joints are made with gas-tight welding. The two halves of the retort are joined by bolts, and gas leakage is prevented by means of a heavy asbestos gasket.

A convenient feature of this furnace, especially for small shop use, is the fact that it can be used as an air-drawing furnace for the tempering of steel. Fig. 3 shows the furnace arranged for this class of work. The change is made simply by removing the ring cover *A* and the nitriding retort *B* and swinging the air-drawing cover *C* into place. This can be done in a few moments. The nitriding retort shown at *B* has a basket 14 5/8 inches in diameter by 19 1/2 inches deep for holding the work. This type of furnace may be obtained in several sizes.

In Fig. 4 is shown a standard box-type electric furnace adapted for nitriding. The removable racks and rollers provided for handling the retort may be seen in this illustration. After inserting the retort, bricks are piled up around the gas inlet and outlet pipes to prevent excessive heat losses. If it is undesirable to replace the hearth plates in the furnace with racks and rollers, the rollers may be attached to the sides of the retort and the furnace used with no other change except to brick up the space around the ammonia pipes. The composition of steels adapted for nitriding, the preparation of parts to be given certain properties, and special methods of handling such work will be described in a succeeding article.

Accelerating the Replacement of Obsolete Machine Tools

By J. R. WEAVER, Superintendent of Manufacturing Equipment, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

A great deal has been written about the replacement of obsolete machine tools. The mechanical journals have advocated a definite replacement schedule for some time. They have urged all machine tool users to investigate the condition of their equipment and to take advantage of the improved designs now available. I feel that the technical journals have done a good job and I believe that the machine tool builders could greatly aid in this campaign for replacing obsolete shop equipment.

It has occurred to me that machine tool builders might use some definite follow-up system for the replacement of machine tools. For example, suppose that the manufacturers should make a check-up of all machine tools sold by them prior to 1920. My idea is that each manufacturer would try to ascertain the location of such machines and then determine what class of work the machine is being used for, its present condition, cost of maintenance, and any other information that may bear directly on the obsolescence of the machine. This information could then be compared with the results obtainable with a modern machine under the same conditions of service. It might prove to be advisable to replace the old machine with an entirely different type.

After the machine tool builder had made this investigation in some one plant, he could prepare a report that would show the user the advantages to be gained by a systematic replacement program. If the machine tool builder should put before the board of directors of a manufacturing plant a plan or procedure whereby all the machine tools in the shop would be replaced according to a definite schedule, it is likely that the subject would receive a great deal more attention than it now does. If the schedule covered a period of five years, for example, the directors might be induced to provide the necessary funds to carry on a continuous replacement program.

It is a fact that it is often difficult for the shop executive to convince the general manager or the board of directors that certain machine tools should be replaced; but a shop executive armed with a well prepared report to back up his request would have a considerably greater influence.

A five-year replacement plan of the type referred to is actually in operation in one large manufacturing plant. The plan was put in operation three years ago and has been found to give very satisfactory results. It would be well worth while if other manufacturers would consider a similar plan. The efficiency of their plants could be greatly increased in this way.

* * *

NEW WOODRUFF KEY STANDARDS

The American standard for Woodruff keys, key-slots and cutters has now been approved by the American Standards Association, and copies of this standard, containing explanatory text and tabulated dimensions, may be obtained from the American Standards Association, 29 W. 39th St., New York City. The price is 35 cents a copy. The standardization of Woodruff keys was undertaken with a view to establishing a simplified series to replace, with the least possible disturbance, the several individual standards in use, thus insuring interchangeability of keys made by different manufacturers and eliminating, as far as possible, the special or little used sizes. Tables of sizes of keys, key-slots, and cutters will be published in MACHINERY'S Data Sheets during coming months.

Testing Drawing Qualities of Aluminum Sheets

Users of Aluminum Sheet Stock Should Find the Cupping Test of Value for Determining Rapidly the Drawing Quality of the Metal

By ROBERT J. ANDERSON

Fig. 1. Machine for Testing Drawing Qualities of Aluminum Sheets under Operating Conditions

THE following article is based upon hundreds of tests conducted to obtain data on the drawing qualities of aluminum sheets of different degrees of hardness and of varying thicknesses. The results of these tests are listed in the accompanying table, and in conjunction with the testing machine shown in Fig. 1, provide a simple and rapid means of determining how close the material approaches the standard drawing qualities specified at the time of its purchase. In this way, the purchaser may eliminate much of the trouble frequently experienced in the press department because of variations in the sheets used.

In order that the table will be more clearly understood, the manner of making the test will be described. Strips cut from the sheets are used in making these tests. They are placed between the punch and die in the machine shown in Fig. 1. A sectional view of the punch and die is shown in Fig. 2. Here it may be seen that the punch is the lower member and is of a semi-spherical shape. In the position shown, the punch has drawn the center of the blank into a cup shape as it passed by the edge of the die. This cupping action is similar to the actual drawing process, provision being made for indicating inferior drawing qualities promptly.

After placing a blank under the die, the die is screwed down snugly on the blank and then released so that there will be about 0.001 inch between the die and the blank. Care must be taken not to allow an excessive clearance here; otherwise buckling of the stock will result.

As the punch moves upward and forces its way through the die, the depth of the cup is indicated on a dial gage located at the top of the machine. The pointer of this gage is in contact with the top of the cup being formed, so that the increase in depth may be noted as it takes place.

One of the important advantages of this machine is that the surface condition of the cup being formed may be viewed directly, the pressure applied being registered on another gage located at the side of the machine. The use of these gages makes it unnecessary to depend upon the human element in determining the pressure corresponding to the cup depth at the point of rupture.

In testing each piece, it is usual to determine the pressure corresponding to a cup depth of 0.250 inch, after which the punch is forced upward until rupture occurs. Just as this takes place, the reading of the pressure gage is taken in order to ascertain the pressure causing rupture.

It has been found, in testing aluminum sheets, that it is unnecessary to regulate the speed with which the punch travels closely, as this factor does not affect the results. However, it is probably just as well to adhere to some uniform speed. In the tests, the results of which are given in the table, the punch was operated at a fairly fast rate of travel. The values of different gages of aluminum sheet of commercial grades are given in the table.

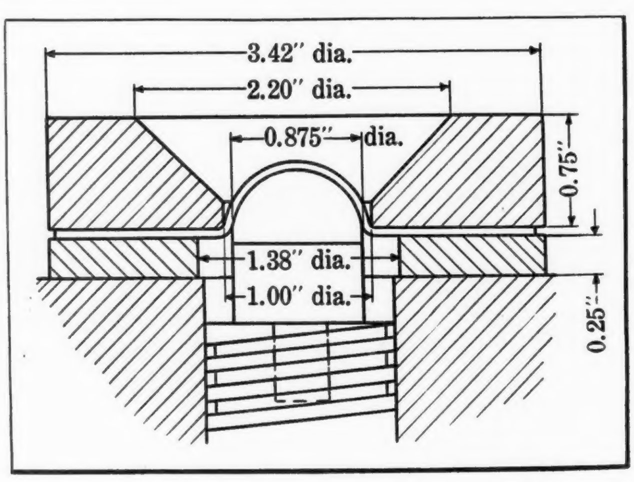


Fig. 2. Section of Punch and Die Used in Machine Shown in Fig. 1

It is interesting to note the effect of increasing hardness of the sheet on the depth of the cup. The appearance of the fractured dome of the cup as it is being tested is of great importance. In soft annealed metal, a smooth dome will indicate good drawing qualities, provided the cupping values are also up to standard. A rough dome, however, will indicate inferior drawing qualities. This condition is characteristic of over-annealed metal, and is sometimes termed "orange peel" because of the large-sized grain, which will not permit satisfactory deep drawing operations. Low cupping values usually accompany the formation of rough domes in a test.

Values Obtained from Tests to Determine Drawing Qualities of Aluminum Sheets

Brown & Sharpe Gage No.	Thickness, in Inches	Pressure, in Pounds, at 0.25-inch Cup Depth	Pressure, in Pounds, at Rupture Point	Depth of Cup, in Inches, at Rupture Point
Cupping Values of 2SO Sheets (Dead Soft) Scleroscope Hardness 4.5 to 6.5 (Magnifier Hammer)				
10	0.1019	1950	3550	0.415
11	0.0907	1700	3050	0.430
12	0.0808	1450	2700	0.440
13	0.0720	1280	2300	0.425
14	0.0641	1150	2000	0.405
15	0.0571	990	1650	0.387
16	0.0508	900	1450	0.375
17	0.0453	800	1250	0.360
18	0.0403	710	1090	0.350
19	0.0359	630	900	0.340
20	0.0320	575	800	0.330
21	0.0285	490	660	0.322
22	0.0254	440	590	0.316
23	0.0226	380	500	0.311
24	0.0201	345	445	0.306
25	0.0179	315	390	0.303
26	0.0159	275	340	0.297
27	0.0142	250	295	0.288
28	0.0126	200	235	0.277
29	0.0113	180	200	0.270
30	0.0100	150	180	0.260
Cupping Values of 3SO Sheets (Annealed Dead Soft) 1.25 Per Cent Manganese. Scleroscope Hardness 8 to 11 (Magnifier Hammer)				
12	0.0808	1860	3200	0.415
14	0.0641	1500	2400	0.390
16	0.0508	1200	1750	0.350
18	0.0403	900	1200	0.330
20	0.0320	700	900	0.310
22	0.0254	550	675	0.302
24	0.0201	420	475	0.285
26	0.0159	320	350	0.265
28	0.0126	....	260	0.250
Cupping Values of 2S6 Sheets				
14	0.0641	1510	2250	0.354
24	0.0201	....	395	0.215

Brown & Sharpe Gage No.	Thickness, in Inches	Pressure, in Pounds, at 0.25-inch Cup Depth	Pressure, in Pounds, at Rupture Point	Depth of Cup, in Inches, at Rupture Point
Cupping Values of 2S2 Sheets (Quarter Hard) Scleroscope Hardness 9 to 15 (Magnifier Hammer)				
14	0.0641	1400	2100	0.365
16	0.0508	1200	1600	0.340
18	0.0403	820	1020	0.305
20	0.0320	690	730	0.275
22	0.0254	510	550	0.255
24	0.0201	....	365	0.240
26	0.0159	....	265	0.220
28	0.0126	....	160	0.195
Cupping Values of 2S4 Sheets (Half Hard) Scleroscope Hardness 11 to 17 (Magnifier Hammer)				
14	0.0641	1460	2150	0.358
16	0.0508	1160	1500	0.330
18	0.0403	900	1050	0.295
20	0.0320	700	760	0.270
22	0.0254	....	540	0.248
24	0.0201	....	390	0.235
26	0.0159	....	260	0.217
28	0.0126	....	170	0.190
Cupping Values of 2S8 Sheets (Three-quarters Hard)				
14	0.0641	1750	2300	0.333
24	0.0201	....	450	0.210
Cupping Values of 2SH Sheets (Full Hard) Scleroscope Hardness 19 to 26 (Magnifier Hammer)				
14	0.0641	1900	2300	0.310
16	0.0508	1600	1700	0.275
18	0.0403	....	1300	0.250
20	0.0320	....	825	0.228
22	0.0254	....	650	0.210
24	0.0201	....	470	0.200
26	0.0159	....	340	0.185
28	0.0126	....	260	0.175

* * *

Visitors to a certain shop are sure to notice near each grinder, in a prominent position, a small covered box containing two pairs of goggles. The box is surrounded by a large enameled sign bearing in red letters the notice "Do not take chances, use the goggles."

A "900,000-MILE" RAILWAY BEARING

At the Midwest Power Show, held in Chicago during February, the Shafer Bearing Corporation, Chicago, Ill., exhibited their "900,000-mile" self-aligning railway bearings, taken from a test that is still in progress. These bearings have been in operation for more than two years on a test rack at a speed corresponding to 60 miles per hour, with a loading 20 per cent greater than that of the American Railway Association's axle capacity. The bearings show no measurable wear, although up to the present time, they have passed the equivalent of more than 900,000 miles of service.

* * *

The development of electrodes for the welding of various steel alloys during the past year will, according to J. F. Lincoln, president of the Lincoln Electric Co., bring about a much wider application of arc welding and promote a wider use of steel alloys, particularly of stainless steel and other corrosion-resisting metals.

Feeding Work to Grinding Machines Automatically

The trend in the designing and building of machine tools is more and more toward the use of automatic equipment. Recent developments include many new labor-saving devices and mechanisms. Especially is this true in the grinding machine field, where a noticeable demand for cost-reducing devices is evident. Such refinements as automatic work-sizing mechanisms, which transfer the mechanical skill of the workman to the machine, have passed the experimental stage and are being provided on many cylindrical and internal grinding machines. Hydraulically operated fixtures, air-actuated handling devices, and electrically operated mechanisms are readily accepted by users of grinding equipment because of the time that these innovations save. Automatic feeding arrangements which, in some cases, enable one operator to run a battery of three or four grinders have recently come into use.

Since a grinding machine is a profitable production unit only while the grinding wheel is sparking and removing stock, the time consumed in setting up, loading, making adjustments, and gaging must necessarily be reduced if manufacturing costs are to be lowered.

An interesting example of cost reduction is shown in the accompanying illustration. Here may be seen three Cincinnati centerless grinders operating automatically, with interposed hoppers which carry the parts from one machine to the next. The three grinders are operated by one man.

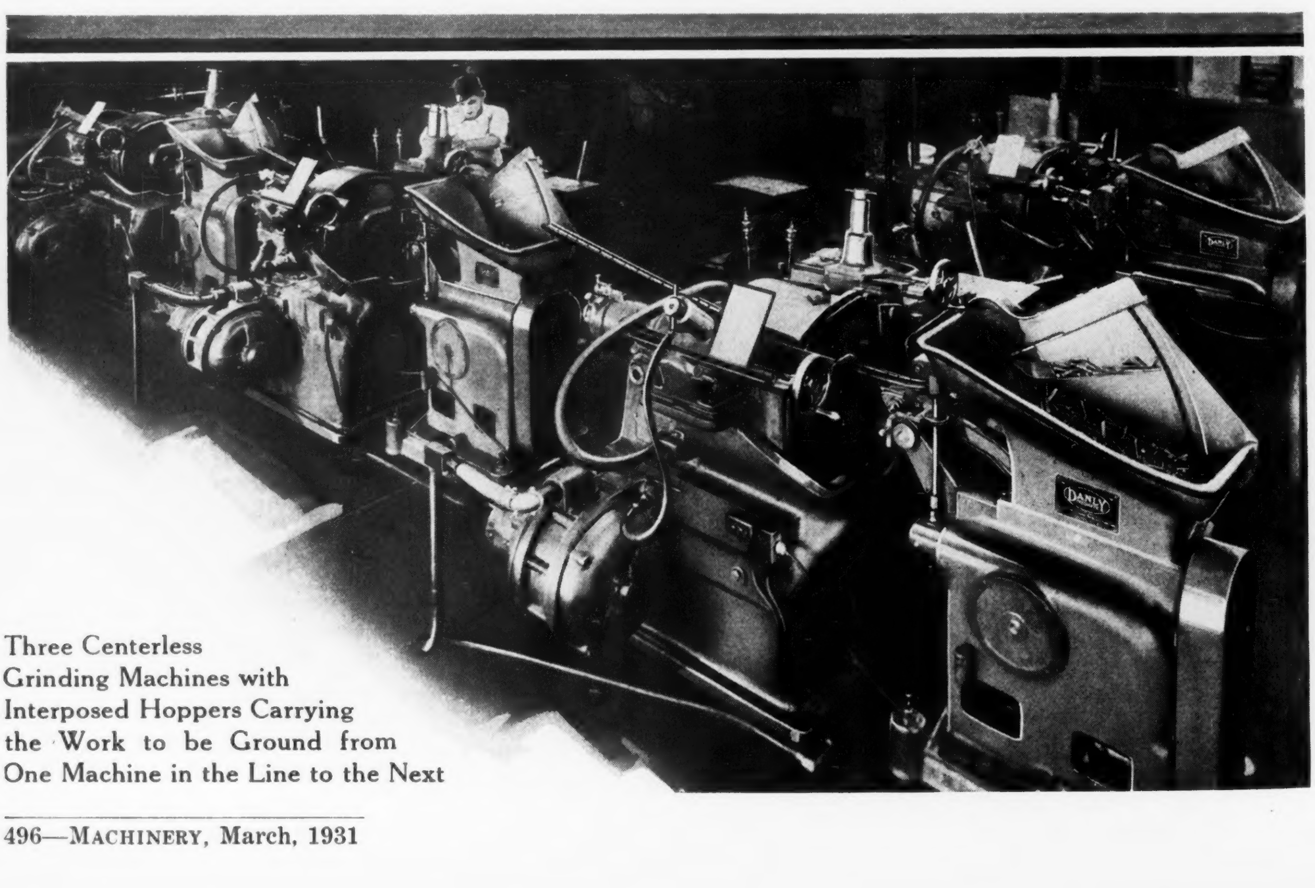
Work is dumped into the first hopper, from which it passes consecutively through the machines for a roughing, a semi-finishing, and a finishing cut. An accurately checked time study showed the labor cost reduction of the grinding operation with the hopper arrangement, on a run of 15,000 dowel-pins, to be 74 per cent. This substantial saving on the grinding operation made it possible to manufacture these pins completely at a total cost of 27 1/2 per cent less than previously, when three men were required for the grinding job. The pins are made from hardened steel, and a total of 0.007 to 0.009 inch of stock is removed during the three cuts. The limits are ± 0.0001 inch.

Not only has straight cylindrical work, such as shafts, rods, bushings, rollers, pins, etc., been fed by automatic arrangements, but headed and shouldered work which is ground on a centerless machine by the in-feed method is also being fed automatically to the grinding position for finishing.

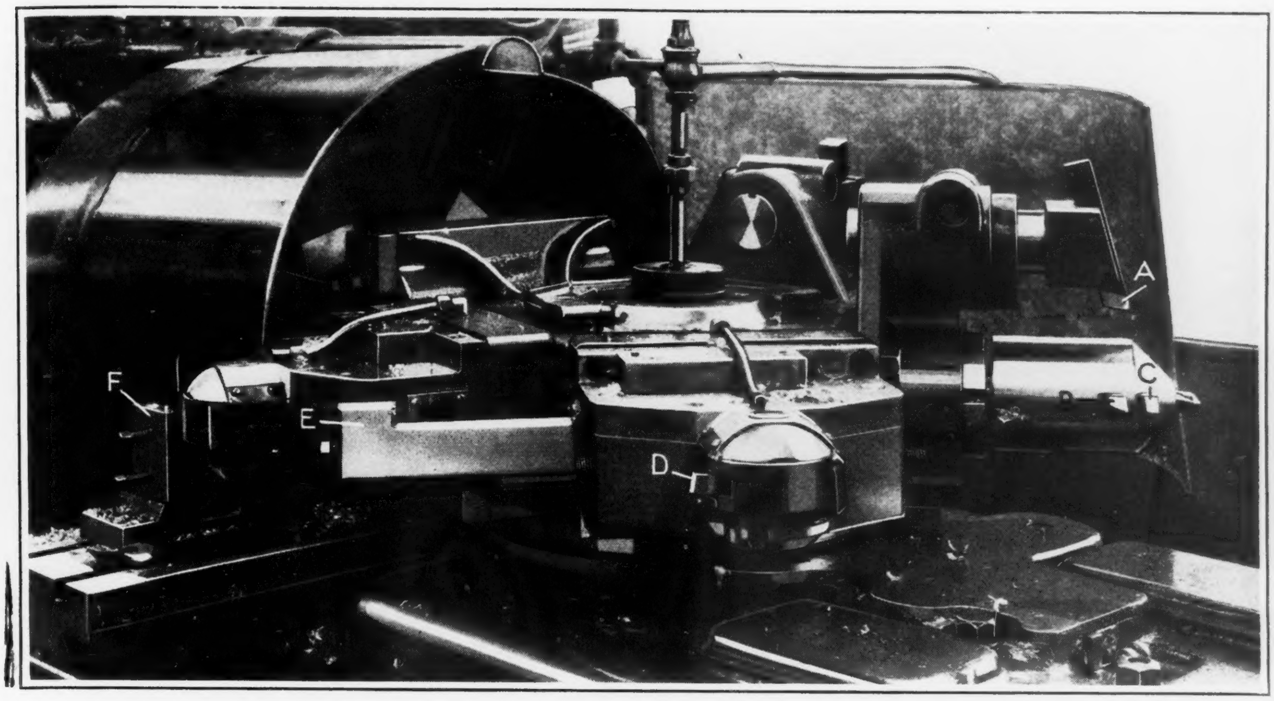
* * *

A PRACTICAL-MINDED STUDENT

I have at least one practical young man in my class. After carefully stressing the fundamentals in spur gearing, explaining to the students how to compute the various dimensions, I proceeded, in the customary pedagogical fashion, to check up on the effectiveness of my instruction by giving a test. To my surprise, on one of the papers, in reply to three questions submitted, were these words: "Consult MACHINERY'S HANDBOOK." After all, this student probably gave the best answer in the group. A mechanical man who knows how to use a handbook to obtain the information that he requires in solving shop problems knows a great deal. J. H.



Three Centerless Grinding Machines with Interposed Hoppers Carrying the Work to be Ground from One Machine in the Line to the Next



Machining Cylinder Heads for Wasp Engines

Operations Performed on Aluminum Alloy Cylinder Heads with Tools and Equipment of Special Design

By FREEMAN C. DUSTON

THE development of aviation has placed more exacting requirements on both designing and mechanical skill than any other developments in the transportation or power field. If something happens to a locomotive or an automobile engine, the train or car generally comes to a stop without further mishap; but, if the engine of a plane stops in the air, pilot and passengers are in grave danger. Exceptional care must, therefore, be taken in the selection of the materials used for aircraft and in the manufacture of every part that enters into an airplane engine.

To meet the exacting manufacturing requirements, considerable equipment of special design is generally needed in airplane engine manufacture. The present article deals with some of the special machines and tools that have been installed in the new plant of the Pratt & Whitney Aircraft Co. at East Hartford, Conn., for machining parts for the Wasp Junior aircraft engine.

Turning, Facing, and Dome-forming Operations on Cylinder Heads

In the heading illustration is shown an automatic with special tool equipment mounted on the turret for performing the following operations on the aluminum alloy cylinder head shown at *A*, Fig. 1: Rough-bore and rough-turn at *B* and *C;* rough- and finish-turn the dome at *D;* finish-face at *E;* cut the seat for the cylinder barrel which is screwed into the head while the head is hot in order to give a shrink fit on the band shown at *A*, Fig. 2; and ream the bore *F*, Fig. 1, which is to be tapped to give the required shrink fit on the thread milled on the cylinder barrel at *B*, Fig. 2.

At *A* in the heading illustration is shown one of the tools that turns an outer surface while the tools *B* and *C* perform boring operations on the inside of the cylinder head. The tool *D* rough-bores the dome at *D*, Fig. 1, which forms the combustion chamber at the top of the cylinder. When tool *D* is indexed into the operating position, the end *E* of a sliding member is engaged by a hooked arm at the rear of the cross-slide *F*. The movement imparted automatically to the sliding member *E* by the cross-slide *F* causes the tool-block which holds cutter *D* to swivel through approximately one-fourth of a circle, thus completing the roughing cut on the dome.

The swiveling movement of tool *D* is effected by means of rack teeth cut on the slide *E* which mesh with the teeth of a gear segment on the tool-holding block. The finishing cut on the cylinder head dome is taken with a spherical turning tool which is a duplicate of the one used for the roughing cut. The dome of the cylinder head is finish-turned to the required radius by having the point of the tool located at the correct radial distance from the center of the bearing about which the tool-holder is swiveled.

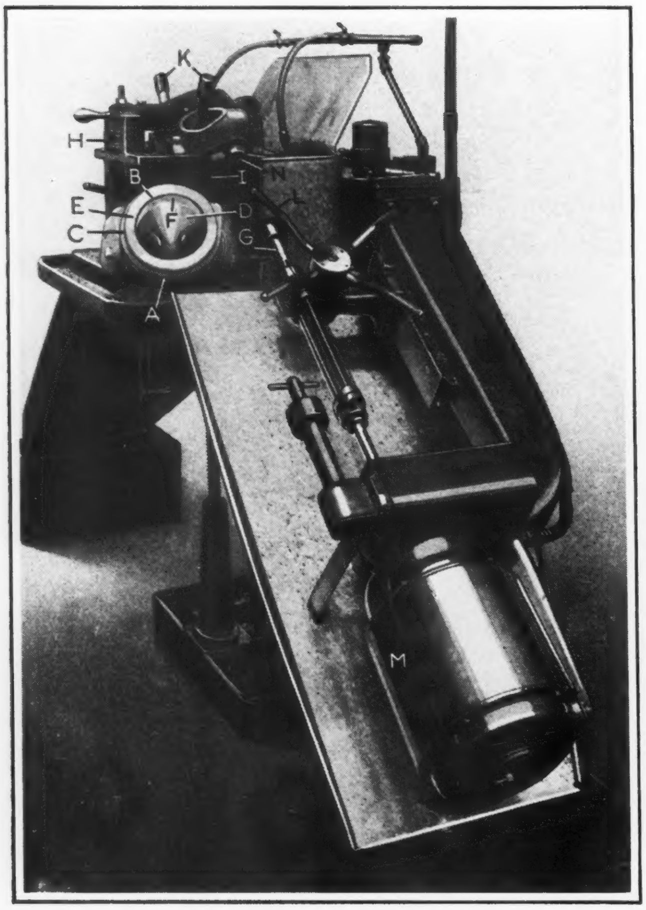


Fig. 1. Machine Designed with Two Motor-driven Spindles for Drilling, Reaming, and Spot-facing the Rocker-arm Holes

band at *A* while the tool *F* in the cross-slide faces the cylinder accurately to length. An end view of one of the combination threading and cylindrical milling hobs is shown at *G*.

Drilling, Reaming, and Spot-facing Rocker-arm Holes

The rocker-arm holes in the cylinder head shown at *A* and *B*, Fig. 4, are drilled, reamed, and spot-faced on the special machine shown in Fig. 1. This machine has two motor-driven spindles *G* located on opposite sides of the fixture *H*. These spindles, only one of which can be seen in the illustration, are positioned at the required angles for drilling and finishing the holes.

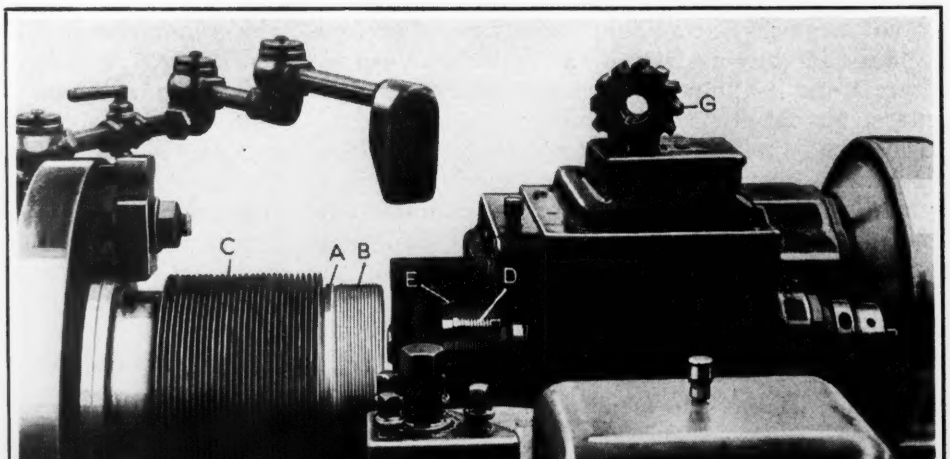
A cylinder head *I* is shown clamped in the fixture ready for drilling. It is located by the finished edge *C* and by plugs *K* which fit into the previously bored and reamed holes for the valve guide bushings. These plugs, of course, extend into bushings in the fixture. The illustration shows the rack and pinion arrangement for feeding the spindle in or out by means of the wheel *L*.

The two motors, one of which is shown at *M*, are tilted at the same angle as the spindles. Bayonet-locking types of chucks and guide bushings enable the drills, reamers, and counterbores to be changed quickly. One of the quick-change bushings may be seen at *N;* in the illustration, the spindle *G* is shown with the tool removed.

The valve bushing holes shown at *A*, Fig. 5, are drilled and counterbored at different angles by the two crossed spindles *C* and *D* of the special machine illustrated in Fig. 4. The fixture is shown

The problem of threading the cylinder barrel at *B*, Fig. 2, to give the accurate shrink fit required in the tapped threads of the cylinder head, and also the problem of finishing the shrink band *A* concentric with the threads, and accurately to size, was solved by employing the special combination cutter or hob *D* on the miller illustrated. The cylinder barrels are made from S.A.E. No. 1050 steel forgings, which show a Brinell hardness of 228 to 241. Great difficulty had been experienced in keeping the usual type of threading tools sharp while cutting the threads on this material. By the use of hob *D*, however, approximately twenty cylinder barrels can be threaded before regrinding is necessary. The cutters at *E* hob the shrink

Fig. 2. Thread Hobbing Machine with Special Hob which Cuts the Thread at B and Mills the Shrink Band at A



in the loading and unloading position, with the cylinder E clamped in place and with gages or plugs F and G inserted in the valve bushing holes to test the location of the counterbored surface. After the holes have been drilled and counterbored with combination cutters, the hinged clamp H is released and swung back, so that the cylinder head can be replaced by a new casting. The work is trued up in the fixture by means of the knurled-head screws J before being clamped by tightening the hand-nut K.

When the work is properly located and clamped in place, the lever L is pushed back to withdraw a pin at M which locks the work-holding portion of the fixture in the position shown. The fixture is then swiveled on the trunnion bearing at N until the cylinder head is in the inverted position necessary for drilling the holes from the combustion chamber side of the cylinder head. The fixture is located in this position by the pin at M. The spindles of the machine run in roller bearings, one of which may be seen at O.

The drills and counterbores are provided with quick-change shanks. The tools used for facing or counterboring the outer ends of the holes can be quickly locked to the ends of the spindles after they have been fed down so that they project a sufficient distance beyond the work. The spindles must, of course, be fed upward for the counterboring operations.

The special machine shown in Fig. 6 has three spindles, each driven by an individual motor. The motors that drive the two horizontal spindles D for performing the required operations on the spark-plug holes can be seen at B. The motor for driving the spindle C which drills and taps the priming hole is like the ones shown at B and is located in line with spindle C. The cylinder head in the fixture has the spark-plug holes S drilled, counterbored on the outside and inside, and tapped to receive the spark-plug bushings. The spindles D are shown with the tools removed. Power feed for the horizontal spindles is obtained through the shafts E.

A close-up view of the fixture with an undrilled cylinder head clamped in place is shown in Fig. 5. It will be noted that the spindles D are not parallel with the face of the fixture, but point toward the open end. Also, the spindle C is not in a vertical

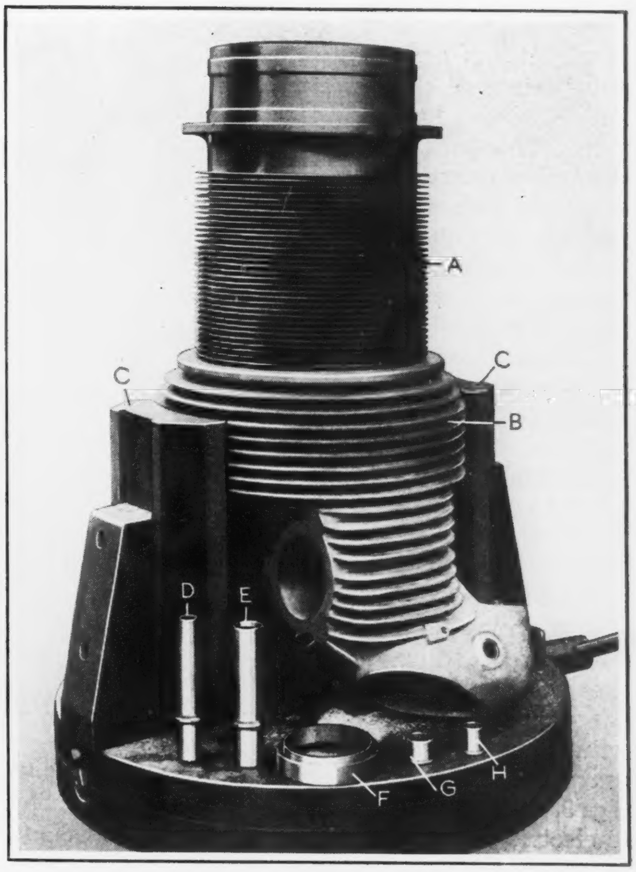


Fig. 3. Assembling Cylinder Head and Barrel; Heated Head is Gripped in Chuck while Cold Barrel is Screwed into Place

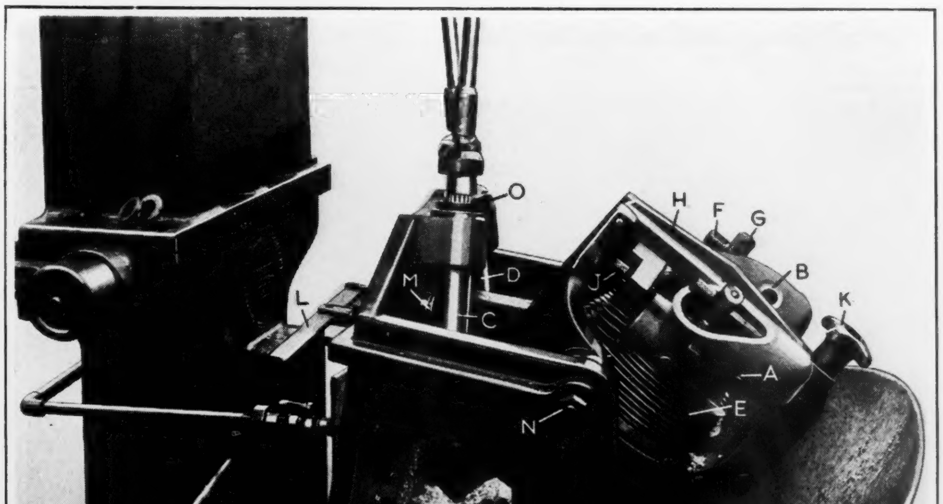


Fig. 4. Drill with Crossed Spindles for Drilling and Counterboring the Valve Bushing Holes and Valve Seats

plane, but is tilted to direct the drill point toward the rear of the machine. To permit the drilled cylinder head to be removed and the fixture loaded with a new casting, the work-holding member *F* is tilted forward by means of the handle *G* after the fixture is released from the drilling position by a movement of the lever *H*. All three spindles have chucks which permit the tools to be changed quickly.

To assemble the cylinder barrel *A* and the cylinder head *B*, Fig. 3, the head is heated in an electric furnace to a temperature of 300 degrees F., and clamped between the vertical chuck jaws *C* while the cold cylinder barrel is screwed into place. At *D* and *E* are shown the valve stem guide bushings which are also pushed into the machined holes at *A*, Fig. 5, while the head is hot, in order to obtain a shrink fit. One of the two phosphor-bronze valve seats shrunk into the counterbores at *K*, Fig. 5, is also shown at *F*, Fig. 3, together with some of the smaller bushings *G* and *H*.

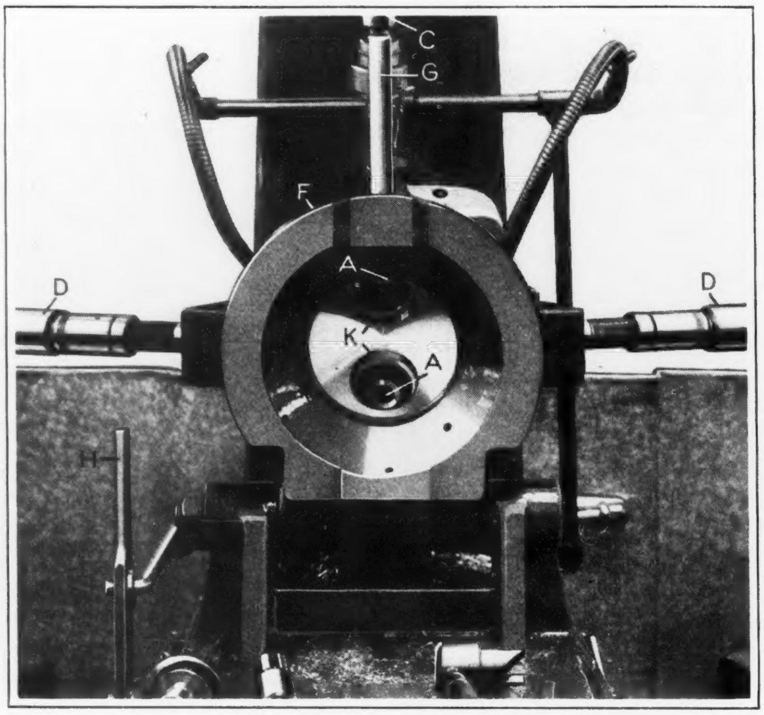
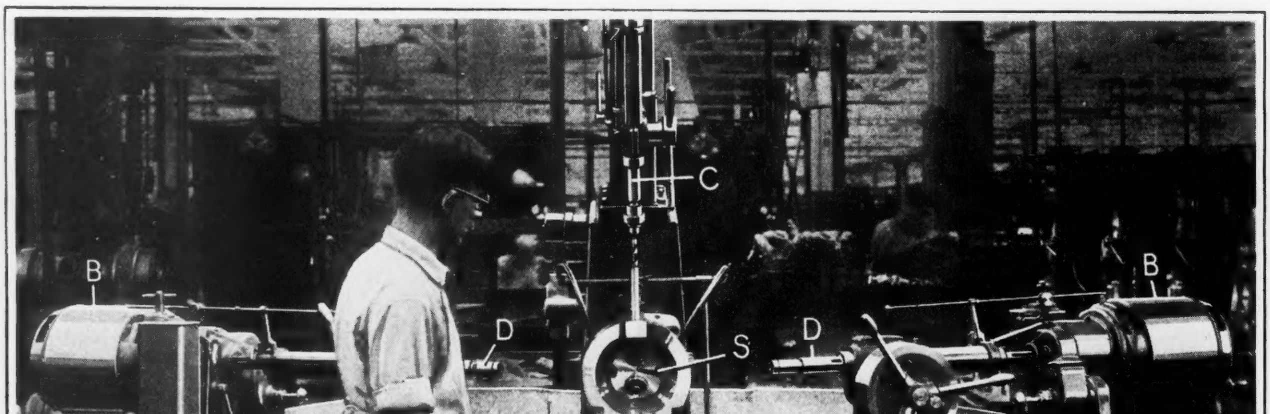


Fig. 5. Close-up View of Fixture on the Machine Shown in Fig. 6, which Drills and Counterbores the Spark-plug and Priming Holes

Fig. 6. Special Machine for Drilling, Counterboring, and Tapping the Priming and Spark-plug Holes

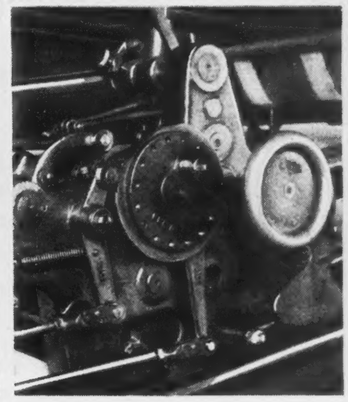


STABILIZING EMPLOYMENT

A stabilization-of-employment plan whereby employes of the Incandescent Lamp Department of the General Electric Co. will be guaranteed fifty weeks' work for the year 1931 has been announced by Gerard Swope, president of the company. This guarantee applies to employes who have been with the company continuously for not less than two years. The plan provides that should there be less than thirty hours' employment in any one week, employes will receive full payment for thirty hours' work. The plan will become effective if 60 per cent of the eligible employes of each of the Lamp Works of the company accept the plan, which includes the contribution of 1 per cent of the weekly earnings to provide for a fund out of which wages will be paid in case of reduced employment.

The steps taken by several manufacturers in establishing steady employment are among the promising signs of real industrial progress.

Ingenious Mechanical Movements



HYDRAULICALLY CONTROLLED AUTOMOBILE TRANSMISSION

By ALFRED C. ANDERSON

Transmissions for cars driven by internal combustion engines must be designed to provide the required speed changes, a reverse or backward motion, and a neutral position to permit of stopping the car while the motor continues to run. The transmission which is the subject of this article provides unlimited speeds from zero to the high or direct drive, and all speed changes, as well as the neutral position and the reverse, are controlled by a single foot-pedal, there being no gear-shifting lever.

Fig. 1 is a general view of this transmission, which has been tested under road conditions as explained later. Fig. 2 shows a cross-sectional view, and Fig. 3 an end view of the "fluid clutch" or hydraulic part of the mechanism.

The two opposed cylinders *A*, Figs. 2 and 3, are attached to the engine flywheel, and another pair of opposed cylinders *B* is attached to shaft *D*, which is offset, or eccentrically located, relative to the main center line *x–x*. The four pistons *C*, Fig. 3, located in the four cylinders, are in the form of a one-piece cross with arms of equal length, located 90 degrees apart; consequently, the two pairs of cylinders always rotate together and one pair is held at right angles to the other.

Rotation of the cylinders and pistons may or may not be accompanied by a reciprocating motion of the pistons in the cylinders. Such a motion will occur, due to the offset position of cylinders *B* and shaft *D*, unless the pistons are locked hydraulically so that movement is impossible. When the pistons are locked relative to the cylinders, the direct or high-speed drive is obtained.

The clearance spaces in all cylinders and the holes through the piston arms are always filled with lubricating oil. If the four-way plug valve *P*, located at the intersection of the holes in the pistons, is closed so that oil is trapped in each cylinder, any movement of the pistons relative to the cylinders is prevented. (The control of this valve by foot-lever *T* will be explained later.)

When the pistons are thus locked, the various parts of the transmission from the motor shaft to the rear transmission shaft *J* rotate as a unit. These parts include, in addition to the cylinders, pistons, and eccentric shaft *D*, the eccentric bushing *E* (which is keyed to casing *M* and is free to turn with it in the main casing *N*), pinions *G* in casing *M* (which carries the pinion studs), internal gear *H*, and shaft *J* to which it is connected.

During this direct drive, the axis of eccentric shaft *D* rotates around the common axis *x–x* of the transmission, but shaft *D* does not turn about its own axis. The eccentric bushing *E*, in which shaft *D* is free to revolve, is forced to rotate about axis *x–x* by shaft *D*. While driving direct, pinions *G* cannot rotate about their own axes, because on one side they are in mesh with the driving pinion of *D*, which is locked against rotation about its axis, and on the other side they mesh with internal gear *H*, which offers resistance to rota-

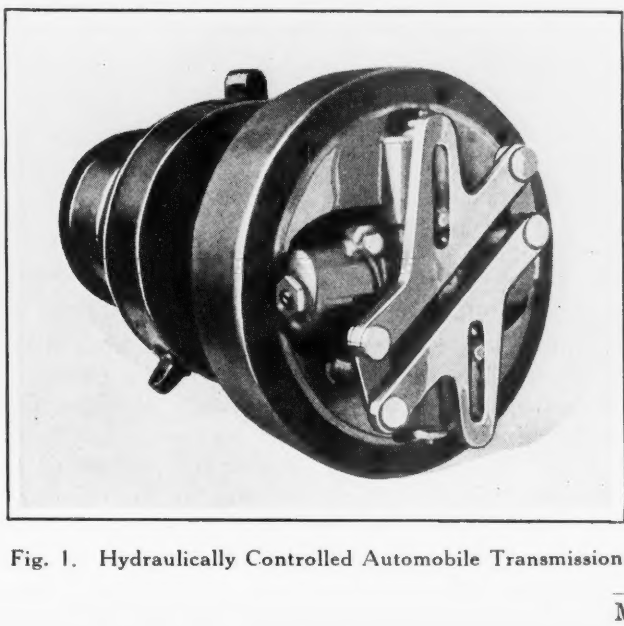


Fig. 1. Hydraulically Controlled Automobile Transmission

tion due to the fact that it is coupled indirectly to the wheels of the car. The result is that pinions G merely act as locking members or driving keys between the pinion of shaft D and internal gear H.

The action of the mechanism during the intermediate speed changes and when in neutral will perhaps be easier to understand when the movement during the reverse drive is described. Valve P, which was tightly closed for the direct drive, is wide open for reversal, thus allowing the oil to flow freely and permitting the pistons to reciprocate. The result is that eccentric shaft D now rotates about its own axis, but it also has a planetary movement about axis x–x, because when valve P is either partly or wide open, the eccentric bushing E, being keyed to casing M, is free to rotate when pinion gears G revolve inside internal gear H. When foot-pedal T is pushed down to the reverse position, it first opens valve P and then locks gear-case M and eccentric bushing E against rotation by gripping the gear-case with an external brake-band. The latter action is so timed that it does not occur until valve P is wide open and foot-pedal T controls the action of the brake, as well as that of the valve. With casing M and eccentric bushing E held stationary, motion from the motor is transmitted through cylinders A, the pistons, shaft D, pinions G (which now rotate about pins fixed in casing M), reversing internal gear H and shaft J.

Transmission in the Neutral Position

If foot-pedal T is allowed to rise from the reverse to the neutral position, casing M and eccentric bushing E will remain released from the brake-band and valve P will be wide open. The revolving cylinders A then rotate cylinders B and eccentric shaft D, which merely turns about its own axis and axis x–x. The rotation of shaft D, however, is not transmitted to internal gear H and shaft J, because gear casing M and eccentric bushing E now are free to turn. The result is that pinions G merely rotate planetary fashion inside of gear H, because casing M and eccentric bushing E offer only slight frictional resistance to rotation, whereas internal gear H is coupled indirectly to the rear wheels of the car.

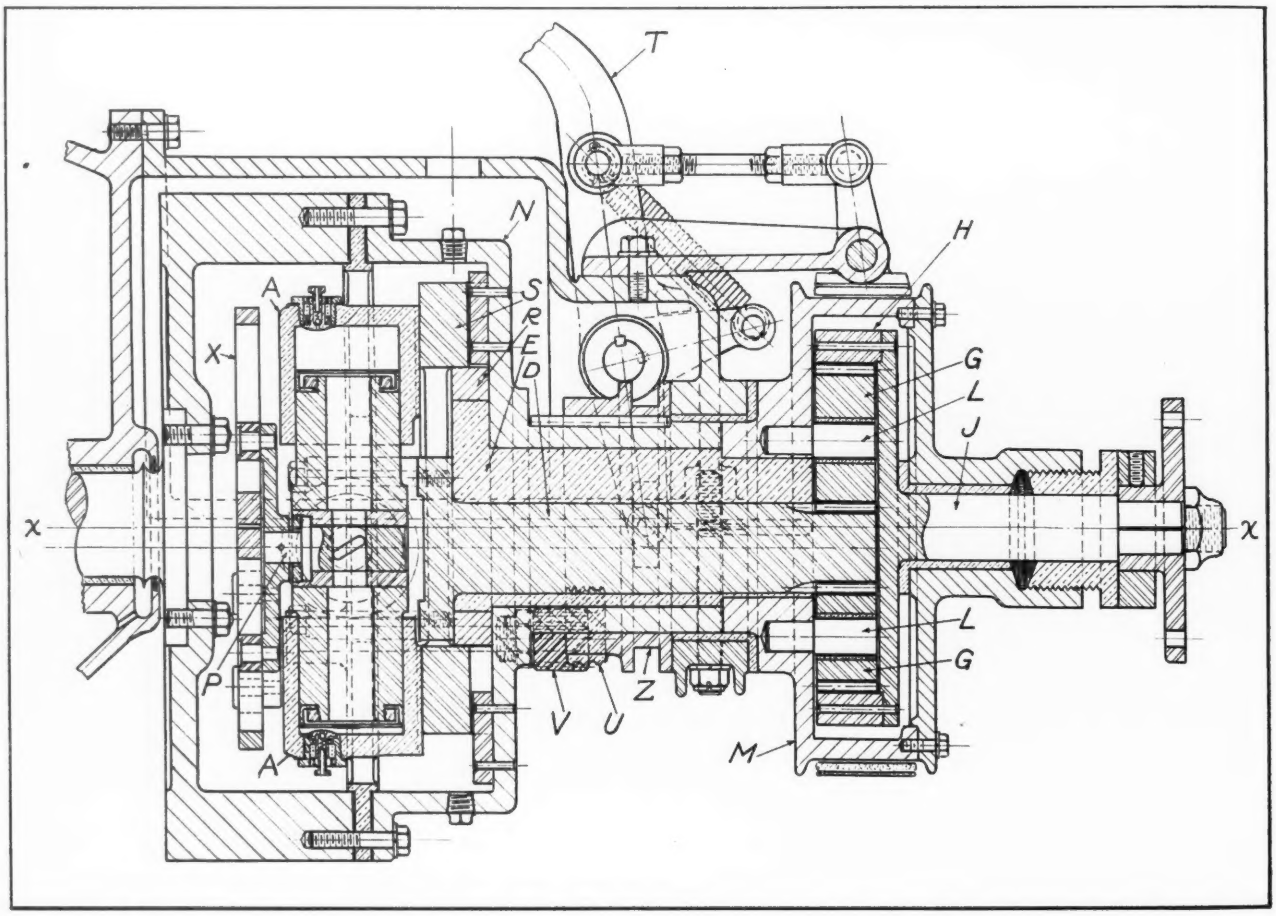


Fig. 2. Sectional View of Transmission Shown in Fig. 1, which is Controlled Entirely by a Foot-pedal

Action of Mechanism During Intermediate Speed Changes

As foot-pedal T is allowed to rise from the neutral position toward the high-speed position, valve P is gradually closed. As it closes, there is a proportionate increase in the resistance to the flow of oil between the four cylinders; moreover, this resistance to the oil flow causes a corresponding increase in the resistance to the rotation of D about its axis until, finally, when valve P is completely closed, there is no such rotation, shaft D merely

turning about axis x–x. However, when valve P is partially opened, shaft D has a planetary movement, there being rotation about its own axis and about axis x–x. This movement about axis x–x is, of course, accompanied by rotation of eccentric bushing E, which is forced to rotate by the studs in casing M when its pinions G revolve idly around H in the neutral position.

Now when shaft D begins to turn about axis x–x at an increased rate due to increasing the resistance of the oil, rotary motion will be transmitted to gear H at a rate depending upon the planetary movement of shaft D and its rotation about its own axis. The planetary movement increases and the rotation about the axis diminishes as valve P is closing. Finally, when the valve is entirely closed, thus preventing all rotation of shaft D about its own axis, pinions G act something like fixed keys that connect the pinion of shaft D with internal gear H, as previously mentioned.

The movement of foot-pedal T is transmitted to a sliding collar Z, which, in turn, slides a helical gear segment U that is continually in mesh with two helical pinions V keyed on short shafts W (Fig. 3). A quarter turn of these shafts can be obtained easily, as the gear segment slides in an axial direction while guided by a key to prevent rotation. This rotary motion of the pinion shafts is transmitted to the inside of the casing through oil-tight bearings. The elongated slots in the connecting link X (see Figs. 1 and 3) allow space for the valve lever rolls to operate in when the pistons are reciprocating in the cylinders.

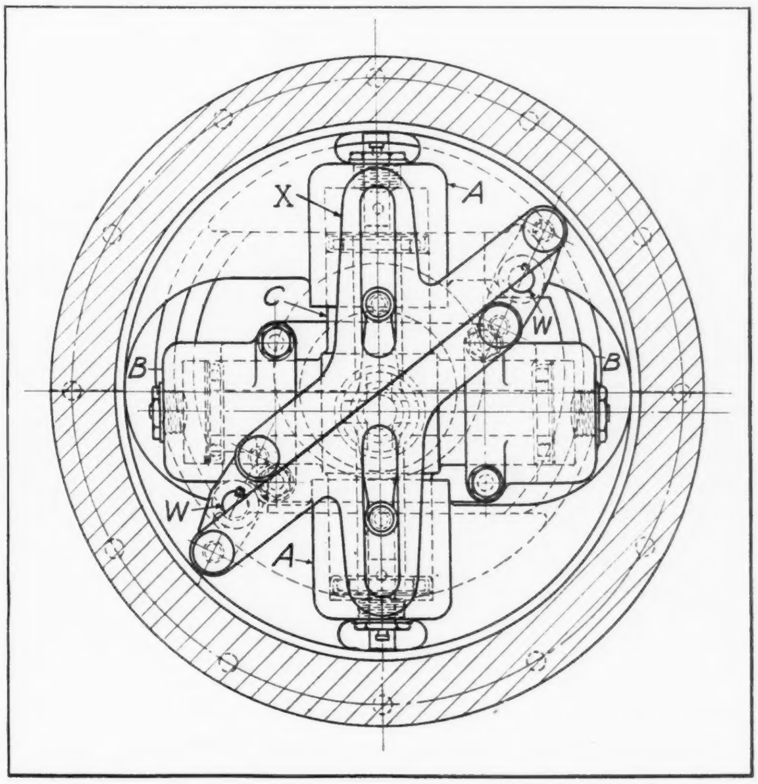


Fig. 3. End View, Showing Arrangement of the Cylinders and Pistons of the "Fluid Clutch"

The car responds to the slightest touch of the foot-pedal without any jarring action or shocks. No trouble has been experienced from excessive heat generated by the compression of the fluid, as there is sufficient radiating surface; this has been proved by tests on the road. The main casing N of the transmission is made oil-tight and should be kept entirely filled with some good quality lubricating oil.

Safety valves are provided at the head of each cylinder, and they are set to blow at 1500 pounds per square inch. In conjunction with each safety valve, there is a sensitive one-way automatic check valve opening toward the inside of the cylinders. If a vacuum is created in the cylinders by the pistons due to insufficient oil as the result of leakage, the proper amount of oil will automatically be restored through the check valves. This is an important provision, since the cylinders must always be completely filled to obtain a smooth, even starting torque.

It is necessary to have two counterbalancing plates R and S, Fig. 2. One is used to counterbalance the two offset cylinders B, and the other to counterbalance the pistons. The plate R is forced to move in opposition to the cylinders by eccentric bushing E, and the other plate S is driven by plate R, but it is keyed so as to slide in direct opposition to the pistons.

This transmission has been applied to a car and subjected to various driving conditions during 1000 miles of road tests. While there is doubtless considerable sliding friction in the design shown, no difficulties have been experienced from overheating, although continuous runs up to forty miles per hour have been maintained for three hours. Nevertheless, the mechanical efficiency can be increased by the use of ball or roller bearings, especially between the eccentric bushing and the main casing. Other changes may also be made subsequently in the construction of this transmission.

* * *

WELDING SOCIETY FORMED IN ST. LOUIS

The St. Louis Welding Society, consisting of sixty-five charter members representing twenty-six concerns in St. Louis, East St. Louis, and Madison, Ill., was formed recently. Temporary headquarters have been established at 4620 Delmar Blvd., at the office of the Hill Equipment Engineering Co., a dealer handling the products of the Lincoln Electric Co. in eastern Missouri and southern Illinois. E. P. Barnes of the Moloney Electric Co., is president, and Basil N. Osmin of the Hill Equipment Engineering Co., secretary and treasurer.

Special Tools and Devices for Railway Shops

Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

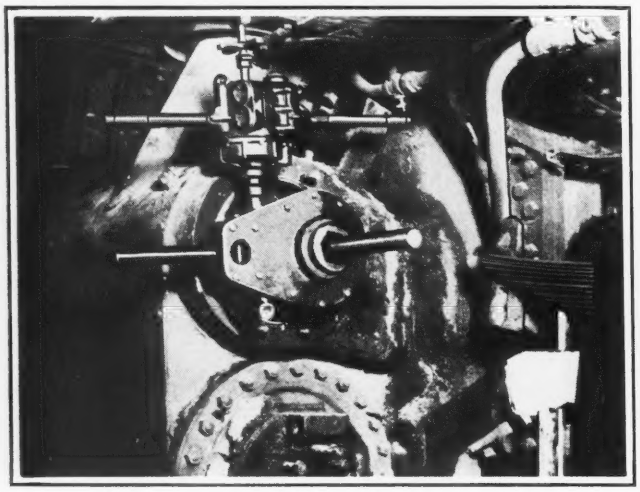


Fig. 1. Pressing Bushings into Valve Bore

PRESSING IN PISTON VALVE BUSHINGS

By H. H. HENSON, Foreman, Machine and Erecting Shop Southern Railway Co., Chattanooga, Tenn.

A great deal of pressure is required to press locomotive piston valve bushings in place in their chambers. Several methods of doing this work are in common use. The one used by the writer is illustrated in Fig. 1. In this illustration is shown a reduction gear unit driven by an air drill. In this case, two opposite bushings are pressed into place simultaneously by means of the two flanged plates *A* and *B*, Fig. 3, in conjunction with the heavy draw-bolt *C*, which has an Acme thread cut on it. The reduction gear unit *D* is shown in position on the end of the screw.

The procedure is as follows: One bushing is started by hand in each end of the bore. The plates *A* and *B* are then located in the position indicated and the draw-bolt passed through them. On the left end of this bolt is a long hexagonal nut which engages the reduction gear unit. The thrust from this unit is taken by means of the ball thrust bearing *E*. When the reduction gear unit is started in motion by means of the air drill, the hexagonal nut turns on the draw-bolt and causes the two plates to move toward each other, thus pressing the bushings into place.

The construction of the reduction gear unit is clearly shown in Fig. 2. It consists chiefly of a simple worm-gear drive having a ratio of 12 to 1. The end of the shaft on which the worm is mounted is tapered to fit the air drill spindle, while the center of the gear has a hexagonal opening which fits the nut on the draw-bolt. The casing of this unit is filled with a good grade of cup grease.

To prevent the entire reduction unit from revolving upon the draw-bolt while in operation, an extension *B* is cast integral with the gear casing. This extension is located against a projection on the work while the bushings are being pressed in.

This unit can also be adapted for driving flue cutting tools, pulling out superheater units, etc.

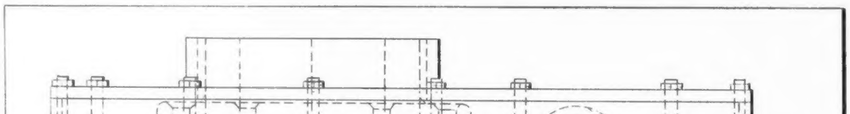


Fig. 2. Worm-gear Reduction Unit which Provides a Powerful Drive for Pressing the Valve Bushings into Place

SIMPLE SHEET-METAL BENDING FIXTURES FOR CAR SHOPS

By A. EYLES, Moston, Manchester, England

More uniform results and higher production rates have been obtained in the sheet-metal bending department of a railroad shop through the use of the simple bending fixtures shown in the accompanying illustration. The fixture shown at *B* is

employed for bending sheet aluminum 3/32 inch thick to the shape indicated at *A*. The fixture or bending form shown at *B* is constructed from steel sheets 3/32 inch thick. After being cut to shape and bent to the required form, the sheet-steel parts of the fixture were assembled by welding.

The wooden block *C*, which is secured to the fixture, is also fastened to the shop floor. The alu-

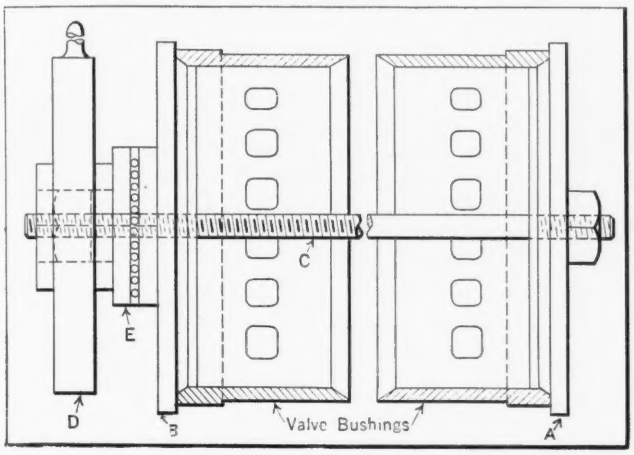


Fig. 3. Equipment Used in Set-up Shown in Fig. 1

minum sheets bent on this form are 12 feet long by 4 feet 6 inches wide, and are for railroad passenger-car roofs. One edge of a flat sheet is placed in the groove at *D*, after which the metal is bent or worked over the rounded portion of the fixture. The partially formed sheet is then lifted from the groove, after which the opposite edge is treated similarly.

At *F* is shown a bending fixture used for forming the elliptical shaped sheet-metal body of the water can *E*. The bending form *G* of fixture *F* is made from 1/16-inch sheet steel. The five pieces of sheet steel required to form the two ends, the center, the bottom portions, and the forming surface *G* are all welded together.

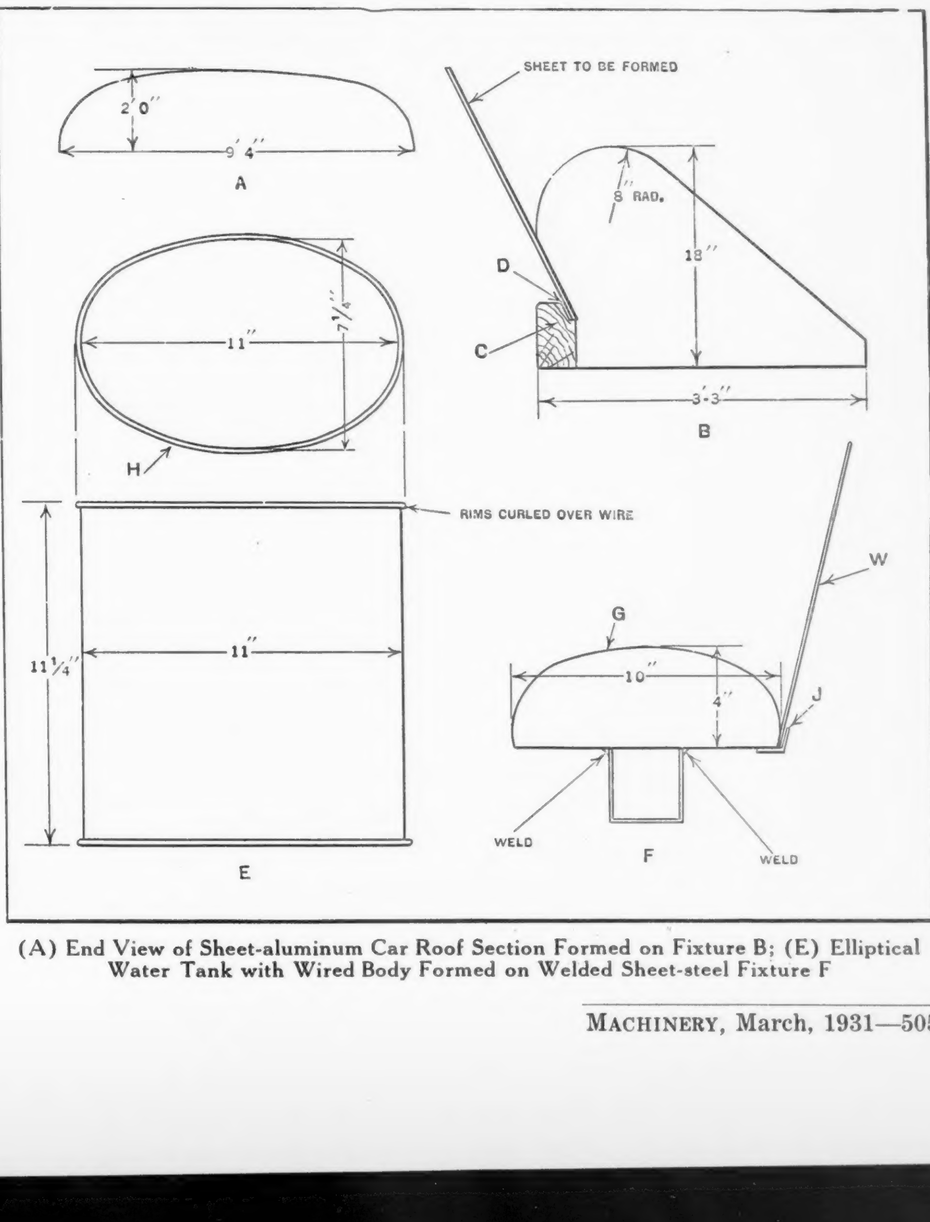
To obtain the elliptical shape shown by the upper view at *H*, one end of the sheet-metal plate is placed in the groove *J* of the fixture, and the metal worked over the form *G* as far as possible. Before performing this operation, the edges of the sheet are curled over the wire. When one side of the sheet has been bent, the other side is subjected to the same treatment. The ends are then joined by soldering.

ALLOWANCES AND TOLERANCES FOR CYLINDRICAL PARTS AND GAGES

A reorganization meeting of the technical committee on Allowances and Tolerances for Cylindrical Parts and Limit Gages (previously designated as Plain Limit Gages for General Engineering Work) was held in conjunction with the recent annual meeting of the American Society of Mechanical Engineers. The original committee was appointed in 1920 under the American Standards Association procedure and sponsored by the American Society of Mechanical Engineers. The reorganization is made under the same auspices.

At the meeting, John Gaillard, mechanical engineer of the American Standards Association, submitted a statement covering the work of the original committee and the attitude that American industry has taken with regard to the results of this work. He recommended to the committee that consideration be given to the following points: The inclusion in the standard of a basic shaft system in addition to the basic hole; an increase in the number of standard fits; and a reduction in the number of steps in the range of nominal diameters. The efforts made to arrive at international unification of standard fits were also mentioned.

Copies of Mr. Gaillard's statement may be obtained from the American Standards Association, 29 W. 39th St., New York City.



(A) End View of Sheet-aluminum Car Roof Section Formed on Fixture B; (E) Elliptical Water Tank with Wired Body Formed on Welded Sheet-steel Fixture F

EDITORIAL COMMENT

What is Saved Now May Prove a Costly Economy Later

During the present business depression the management of many plants is faced by a difficult problem. Costs must be reduced, but how can this be done without disrupting an organization that has been built up with painstaking effort? In some of the large plants, the production and tool engineering departments have been seriously depleted by laying off men who have had long experience with the company's product. It is doubtful if the temporary saving effected in this way is sufficient to offset the great expense that will have to be incurred later when an adequate force must be built up again.

It is easy to reduce the size of an organization; it is not so easy to assemble again a group of men who will work together efficiently. The experienced men in the engineering and production departments often form the very backbone of a concern. They will be difficult to replace when increasing business activity once more requires the work of a complete organization. The cost of training new men is always great, and especially so in these departments. The mistakes that new men are likely to make are often very costly.

Encouraging the Foreman to Study New Equipment

It may seem paradoxical, but it is a fact that there are some managers who discourage rather than encourage their foremen to study the value of new shop equipment. They seem to fear that if the foremen are informed on new developments, they will complain about obsolete machinery and ask for new and more efficient equipment, with the result that either the foreman's request will have to be refused (which may discourage further efforts toward increased efficiency on his part) or too great an expense will be incurred.

In some instances, the foreman is made to feel that when his request for a new machine is granted, the new equipment is bought largely as a favor to him. Under such conditions, it is evident that he will hesitate to recommend the installation of new tools. A foreman who knows his business will ask for new equipment only when the new machines are likely to increase profits, and will resent any suggestion that they are bought mainly because he asked for them.

It is good business for the manager of any shop to encourage his foremen to examine all the equipment in their departments at regular intervals to make sure that none of the machines are obsolete or inadequate, that the cost of repairs is not too great, and that they are not wasting, rather than making, money for the firm. It is also good business to encourage the foremen to keep in touch with the new developments in shop equipment regularly recorded in the technical journals.

What is Required in an Engineering Report?

In preparing a report for the executive of a business or the board of directors, the engineer often makes the mistake of including a mass of detailed information. He overlooks the fact that the executive and the board of directors are more interested in a clear, concise summary, with specific conclusions, than in details.

One essential in an engineering report, therefore, is brevity. The sentences should be brief and figures should be grouped clearly. The paragraphs should be short, as it is much easier to read and grasp the contents of a short paragraph than a long one. If groups of figures must be presented, they should be lined up so that the eye can follow them easily and should be so arranged that those that are most important stand out prominently.

A good report begins with a brief statement of the purpose of the report and what has been investigated, followed by the conclusions arrived at. By glancing over the first few paragraphs, it should be possible to obtain an idea of the contents of the entire report. Details may then follow either under sub-headings or in separate appendices, and may be made as complete as seems advisable.

It is Foolish to Tie Down the Safety Valve

The first steam locomotive built in America was demolished by a boiler explosion a few months after it had been placed in service, because the engineer, annoyed by the steam escaping from the safety valve, tied it down securely. This was just one hundred years ago. In machine shops all over the country, safety valves are tied down in a similar manner today: Guards on machine tools and other equipment are removed; operators fail to use goggles to protect their eyes; risks are taken with belts that may have serious consequences. It is simply a repetition of the action of the foolish engineer who tied down the safety valve.

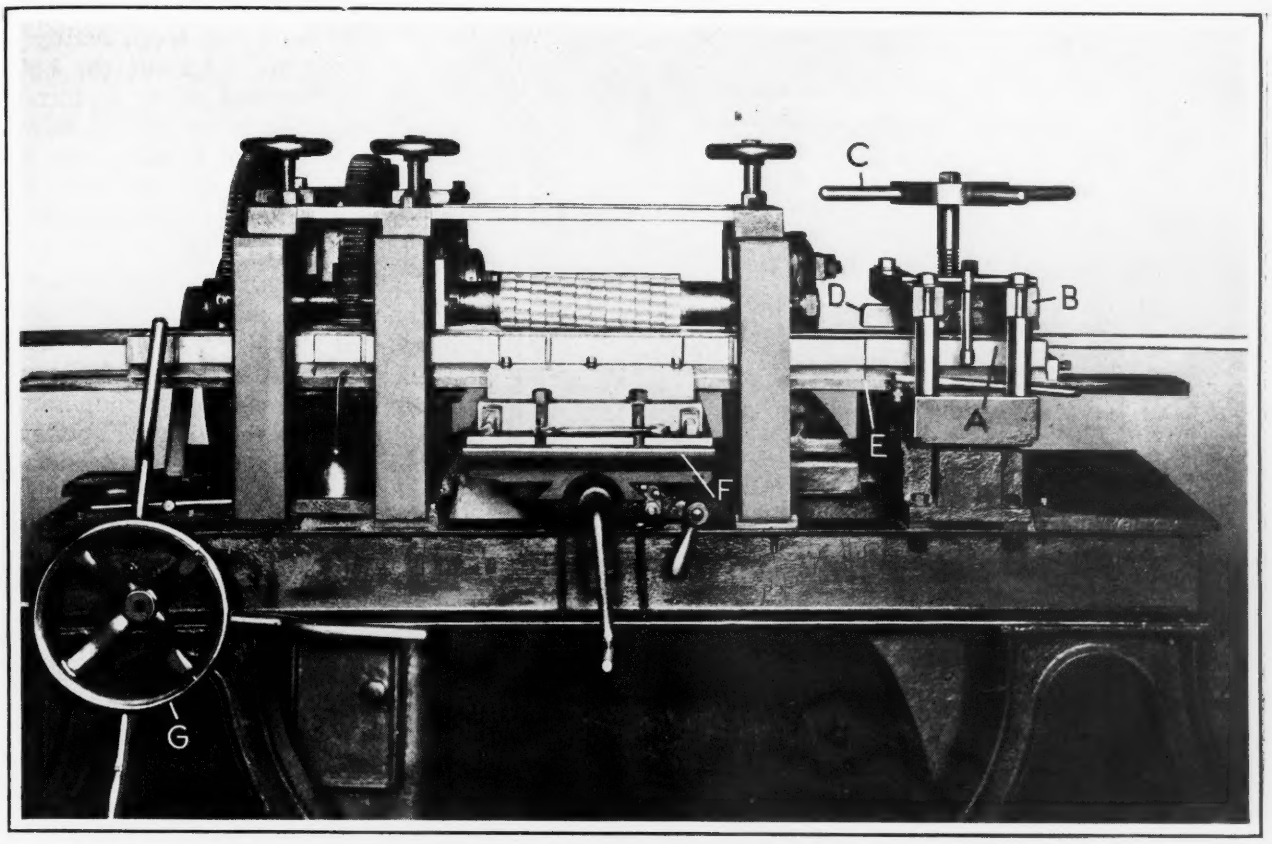


Fig. 1. In This Machine 40 Feet of Saw Teeth are Milled at Each Pass of the Cutter

How Metal-Cutting Band Saws are Made

Special Machine Mills Over 2300 Saw Teeth per Minute and a Hardening Machine Automatically Heats and Quenches the Teeth

By J. E. FENNO

BAND saws are used to a considerable extent in modern shops today for metal cutting. The advantages claimed for them are that, owing to their length, they are self-cooling, seldom requiring a cooling fluid; the loss of metal due to the cut is small, because of the narrow width of the saw; and continuous cutting action is possible, thereby increasing production. Produced at low cost, these saws are generally discarded when dull, because the cost of resharpening them is considered to equal, if not exceed, that of a new saw.

In the manufacture of band saws, the Simonds Saw & Steel Co., Fitchburg, Mass., makes use of special high-production machines, designed and built for this purpose. The principal operations in the manufacture of band saws at this company's plant will be described in this article.

One Machine Mills Over 2300 Teeth Per Minute

The material used in the band saws manufactured by the company mentioned is a chromium alloy steel, which is received at the plant in the form of thin sheets. These sheets are slit to the required width and coiled to facilitate subsequent operations. The saw teeth are milled in the machine shown in Fig. 1. The forming cutter used is 12 inches long, and mills as many as 288 teeth simultaneously, depending upon their pitch. At the right-hand end of the machine is a multiple reel, fastened to the floor, in which are placed forty separate coils of strips. The ends of these strips are carried to the machine and located in one of the removable clamping blocks *A* under the screw press *B*. By means of the star-wheel *C* the liner block *D* is moved down upon the top edges of the strips, so that they are all held at the same height.

While the strips are in this position, a tapered gib in the clamping block is screwed down against the strips by means of a T-wrench, thus clamping them securely. The pressure of the liner block on the edges of the strips is now released, and the clamping block is slid along the guide ways *E* until it is located directly under the cutter. An indexing plunger, operated by a lever at the rear of the machine, is then moved into a hole in the clamping block, positioning the block accurately for milling the saw teeth. As this block is moved toward the cutter, duplicate blocks are secured to the strips in

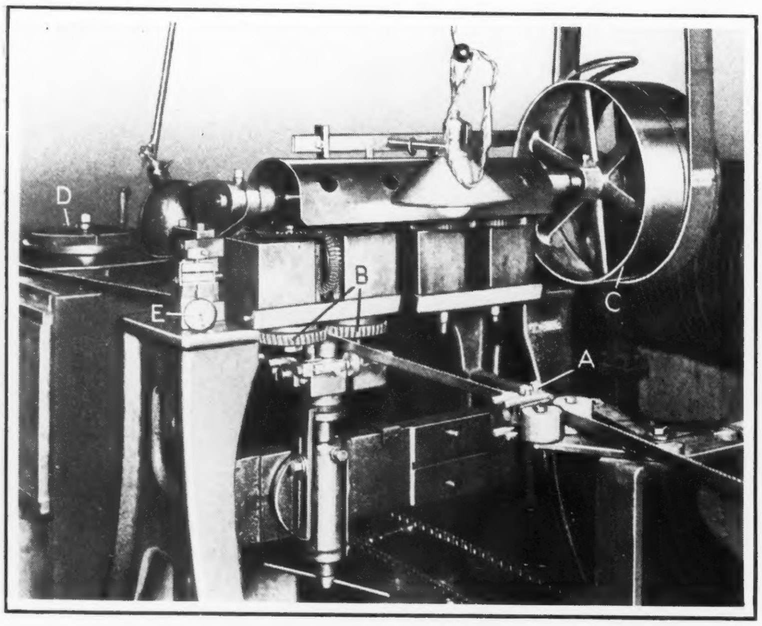


Fig. 2. By Passing the Saw through Rotary Dies, the Teeth are Set in Both Directions Simultaneously

tandem, as shown, each block being the same length as the cutter. After the first block has been indexed, it is fastened in the carriage *F* by means of clamping screws. The cross-feed is then engaged and the strips are fed against the cutter for milling the teeth.

The feed is now disengaged, after which the carriage is returned by hand to its former position and the clamping block is released in the guide ways. The strips, with their blocks, are then moved to the left a distance of 12 inches, or the length of the cutter face, and the second block is indexed and clamped in position. Then the feed is once more thrown in for milling the next section of teeth. While these teeth are being milled, another clamping block is added at the right.

This completes the cycle of operations for every section of teeth milled, each cycle consuming 5 minutes. If the pitch of the saw teeth is 24, then for every cycle, 11,520 teeth are cut, or 2304 teeth per minute. As the milled strips pass out of the machine at the left, the clamping blocks are removed, and the strips are coiled again on a multiple reel by means of the handwheel *G*.

All Teeth are Set at One Passage of the Saw through Rotary Dies

In order to provide clearance for the saw blade in the kerf, the teeth must be set. This operation, performed in the machine illustrated in Fig. 2, may be done in three ways—by bending each successive tooth alternately right and left; by bending one tooth to the right leaving the next tooth without set, and bending the third tooth to the left, the unset tooth acting as a "raker" tooth to clean out the cut; or by giving the teeth what is termed a "wavy" set. The latter, as the term implies, is secured by bending the tooth edge of the saw so that it has a wavy contour, each wave including several teeth.

On a reel at the right is placed a coiled saw, one end of which is passed through the wiper *A* and between the two rotary dies *B*. These dies revolve in opposite directions and are driven through a train of gears from the driving pulley *C*. Around the peripheries of the dies are teeth of suitable shape and pitch for bending the saw teeth to the particular set desired. The dies also serve to feed the saw through the machine; as the saw leaves the dies it is coiled on the reel *D*.

A sprocket chain, passing over sprocket wheels secured to each of the reel spindles, provides a uniform unwinding and winding action for the coil. The dies are interchangeable for the different tooth pitches and sets required, an extra spindle being provided so that each machine may be set up permanently to produce two different sets. The width of the set is checked as it passes through the machine by means of the dial gage *E*.

An Automatic Machine is Employed for Hardening the Teeth

In order to maintain flexibility of the saw while in use, the teeth only are hardened, the rest of the blade being left soft. This is accomplished in the

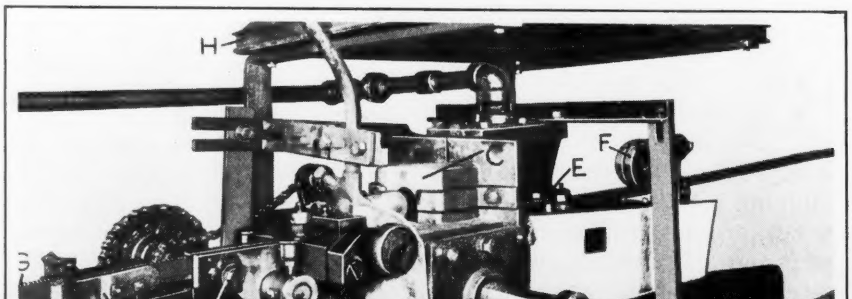


Fig. 3. As the Saw is Fed through This Machine, the Teeth Only are Hardened, the Remainder of the Saw being Left Soft

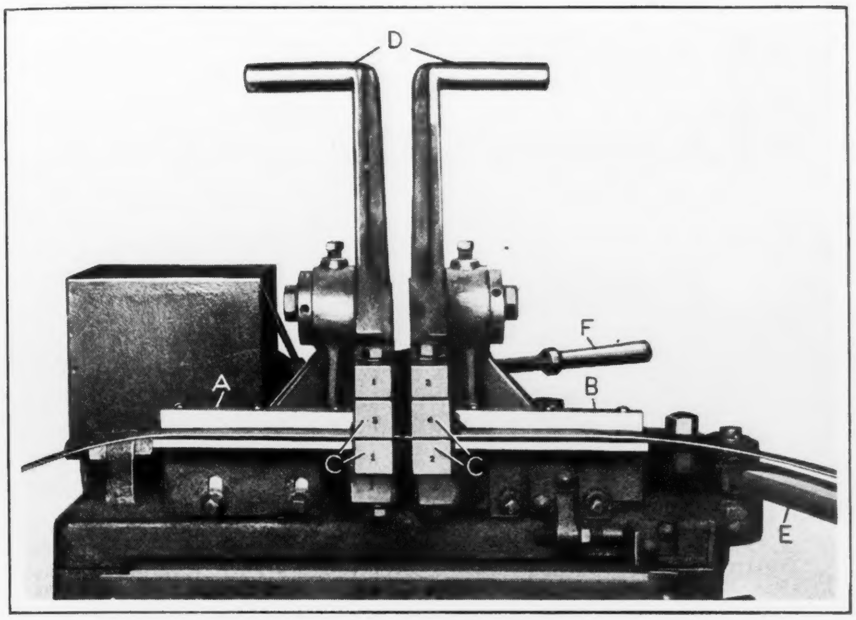


Fig. 4. Set-up for Butt-welding and Annealing the Joint

machine shown in Fig. 3. The saw, shown at *G*, is unwound from a reel at the left and passed through the wiper *A* to remove any foreign substance which might interfere with the hardening process. It is fed through the machine at a constant speed, by means of two friction rolls at *B;* upon leaving the rolls, it passes between two stationary Nichrome blocks, the space between which is slightly greater than the thickness of the saw. The saw projects above the top surfaces of these blocks, so that only the teeth are exposed.

Built over these blocks is the fireclay hood *C*. A gas torch passing into the hood directs a flame against the teeth, heating them to the required temperature. Immediately after the saw passes out of the hood, a stream of oil is played upon the teeth at *E*, quenching them thoroughly.

As the saw continues its motion, it passes through another wiper *F* which removes most of the oil before it is coiled on a reel at the right-hand end of the machine. This reel is fastened to the end of the machine and is rotated by means of a sprocket chain. The oil reservoir forms the base of the machine, the oil being pumped to the saw and returned by gravity. The reservoir is equipped with a refrigerating system that keeps the oil at a constant temperature.

Fluctuations of gas pressure are prevented by an equalizing apparatus located in the main gas line. Hence, by maintaining a uniform heat, oil temperature, and saw speed, every tooth will have the same degree of hardness along the entire length of the saw.

The saw teeth, which are now glass-hard, are tempered by immersing the coil in a vat of tempering salts maintained at a temperature of about 300 degrees F. The coil is removed after a specified time and allowed to cool slowly.

The former method of joining band saws was to taper the ends to make an even joint, and then splice or solder them together. This consumed much time, and in many cases, the joint would separate while the saw was in operation. The present method is to butt-weld the ends. This is done in the welding machine shown in Fig. 4.

The ends of the saw are clamped securely in the copper jaws *C* on the sliding heads *A* and *B* by means of the levers *D*. The two slides are then moved toward each other by lever *E* until both ends of the saw meet, after which the welding current is switched on by shifting the handle *F*.

The joint, which is now solidly welded, is glass-hard and would easily break if it were not annealed. Hence, it is annealed in the same setting by shifting the handle *F* until the weld is brought to a high heat, after which the current is switched off and the joint is allowed to cool slowly. The saw is then removed from the machine, and the joint is ground so that it will be the same thickness as the remainder of the saw. As an example of the strength of the welded joint, it is stated that a saw bent double will fracture at a point some distance from the joint rather than at the joint itself.

* * *

PRODUCTION OF TOOLS, DIES, AND FIXTURES

According to statistics just published by the Bureau of Census, Washington, D. C., the total value of machine tool accessories and small metal-cutting tools made in all industries amounted to $166,537,000 in 1929. The jigs and fixtures were valued at $17,805,000; punches and dies for power presses at $44,814,000, and dies for die-casting and drop-forging at $1,177,000. In the small metal-cutting tool field, drills occupied the most prominent position, the value amounting to $13,960,000; threading tools, not including those used for pipe threading, were manufactured to a value of approximately $9,000,000; while the milling cutters, not including gear-cutting hobs, were valued at $6,645,000. The total value of so-called "small tools" manufactured in 1929 was $54,703,000.

* * *

STANDARD BLANKS FOR GAGES

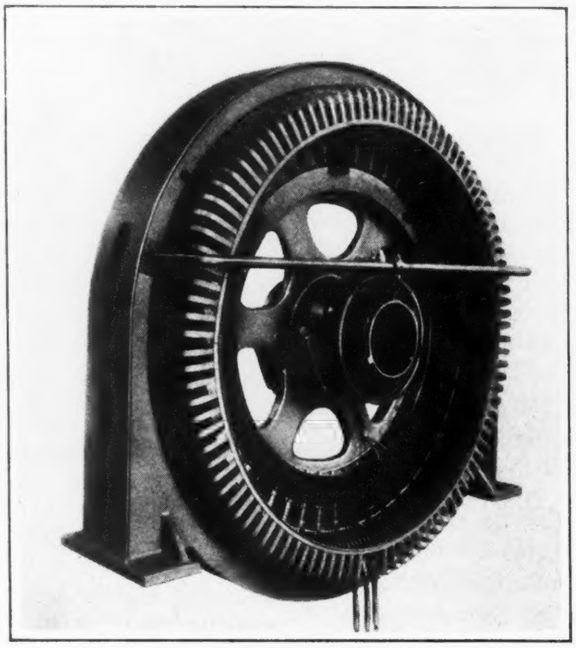
The Bureau of Standards, Washington, D. C., has published a booklet entitled "Plain and Thread Plug and Ring Gage Blanks," giving in detail the tabulated dimensions and standards that have been accepted by the industry and that began to be applied January 1, 1931. The booklet is designated "Commercial Standard CS8-30." Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 15 cents.

Notes and Comment on Engineering Topics

The Gray Iron Institute, Cleveland, Ohio, has created a new technical department, some of the objects of which are to study and advise on specifications; to make a survey of the test bar situation in the light of modern engineering needs; to organize a consulting and information service to which the members of the Institute may present their problems; to issue from time to time research and instruction bulletins on subjects pertaining to the gray iron foundry industry; and, finally, to collaborate with other technical societies and committees in the interest of the gray iron industry.

Time as an economic factor in quantity production was the text of a talk given recently before the Society of Automotive Engineers' production meeting by Professor Paul N. Lehoczky of Ohio State University. He showed that it is now possible for production managers to predict the proper quantity for which to tool up before the year's output is begun. By the use of mathematical equations, he plotted a curve from which he drew such information, saying, in effect, that business no longer needed to wander in the darkness of doubt as to what quantities should be made at one set-up. One conclusion that he drew showed that in the particular case under observation, it was more economical to tool up four times a year, making a quarter of the yearly output during each period, rather than to manufacture the entire quantity at one time.

Five 77,500-K.V.A. hydro-electric generators, the largest of their kind in the world, are now being manufactured by the General Electric Co., Schenectady, N. Y., for the Dnieper River power development in Soviet Russia. The first of these generators will be shipped in April. The total weight of each generator is 880 tons; the rotor and shaft alone weigh 490 tons. The maximum diameter of the machine is 42 feet, and the over-all height over 40 feet. Fabricated welded construction is used for all the large units, so that no large castings need be made. In addition, four similar hydro-electric generators will be constructed jointly by the General Electric Co. at Schenectady and by the Soviet Republics at their Russian plants. These four units will be assembled in Russia. About one hundred and thirty railroad cars will be required for the shipment from Schenectady to New York, where the equipment will be loaded on a steamer bound directly for the mouth of the Dnieper River.



The all-welded steel stator frame for synchronous motors built by the Electric Machinery Manufacturing Co., Minneapolis, Minn., shows that pleasing lines can be obtained with welded construction

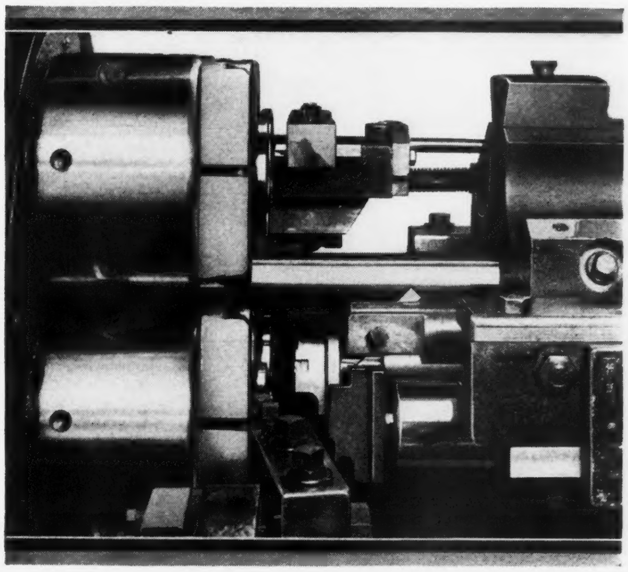
The Swiss State Railways are, at the present time, constructing new electric locomotives that are unusually large and powerful. If not the largest, they certainly are among the heaviest ever built. These electric locomotives are to be 111 feet long and will weigh 245 metric tons (approximately 540,000 pounds). They will be able to pull express trains of 600 tons weight at a speed of thirty-eight miles an hour over the steepest grades of the St. Gothard line, which carries much of the railway traffic from northwestern Europe down into Italy across the Alps.

In the annual report of the Director of the Bureau of Standards, it is mentioned that the Bureau performed in the fiscal year ended June 30, 1930, over 200,000 tests, of which more than 62,000 were made for manufacturers, and 131,000 for government departments and state institutions, while the remainder were made primarily for the Bureau's own use. Of these tests 277 pertained to length-measuring devices, 2714 to gages and gage steels, 308 to pyrometers and similar instruments, and 1135 to other engineering appliances.

The Broadening Field of Tungsten-Carbide Tools

Milling Cutters, Drills, Forming Tools, Counterbores, and Other Cutters are Now Available with Carboloy Tips

By J. A. Markstrum, Chief Engineer, Continental Tool Division of the Ex-Cell-O Aircraft and Tool Corporation, Detroit, Mich.



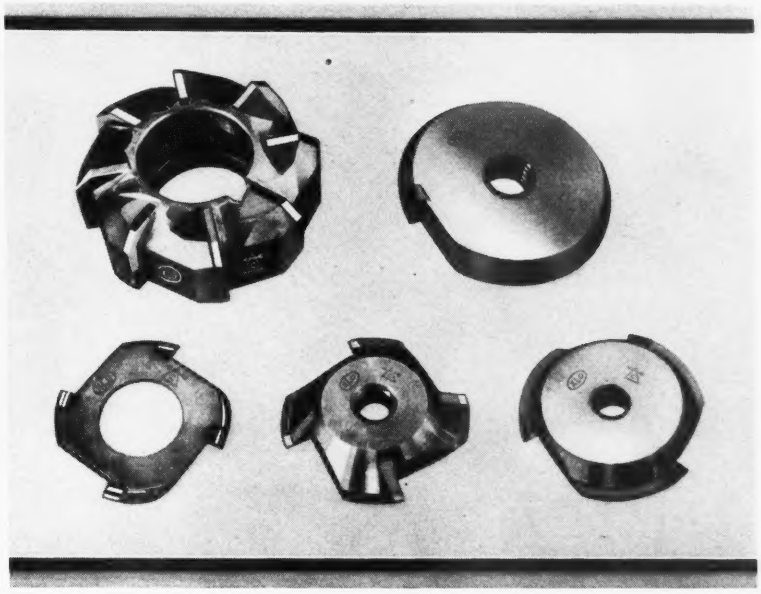
DURING the primary stages of the use of tungsten-carbide tools, it was natural that the simplest types of tools should be employed in determining the possibilities of the new cutting alloy on various materials. Lathe tools were most generally experimented with, as the tungsten-carbide tips could be brazed to rugged shanks, and, furthermore, the lathe furnished a convenient means of experimenting with different work speeds, tool feeds, and depths of cut. It was then merely a short step to applying tools tipped with tungsten carbide to the planer and shaper.

With increasing knowledge concerning the performance of tungsten carbide on different metals and materials, its application has constantly broadened. Tools such as hollow mills, spotfacers, reamers, circular forming tools, drills, and counterbores are now made of the new cutting metal. One of the pioneers in developing cutters of this type has been the Continental Tool Division of the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich. This concern uses the cemented tungsten carbide known as Carboloy for the tips, and alloy steel for the bodies. Typical examples of these cutters are illustrated here.

Just as in the case of lathe, planer, and shaper tools tipped with Carboloy, cutters of the types mentioned in the preceding paragraph must be designed with a strong, rigid backing for the Carboloy tips. Another essential is that the tips be brazed securely to the cutter body. Any tendency of a tip to "give" during a cut will result in its chipping or crumbling, and therefore the utmost precautions should be taken to eliminate such possibilities. The clearance and rake angles should be made considerably less than in high-speed steel cutters, so as to provide the maximum support for the cutting edges.

Another important requirement is that the Carboloy tips have keen cutting edges, free from any saw-tooth effect when observed under a microscope. The cutting edges are ground in standard tool-room machines equipped with abrasive wheels that have been developed by the manufacturers specially for use on tungsten carbide. Owing to the inherent hardness of Carboloy, the grinding process is much slower than on high-speed steel.

Fig. 1. Counterbore, Circular Forming Tool, and Combination Forming and Cutting-off Tools, All of which Have Carboloy Tips



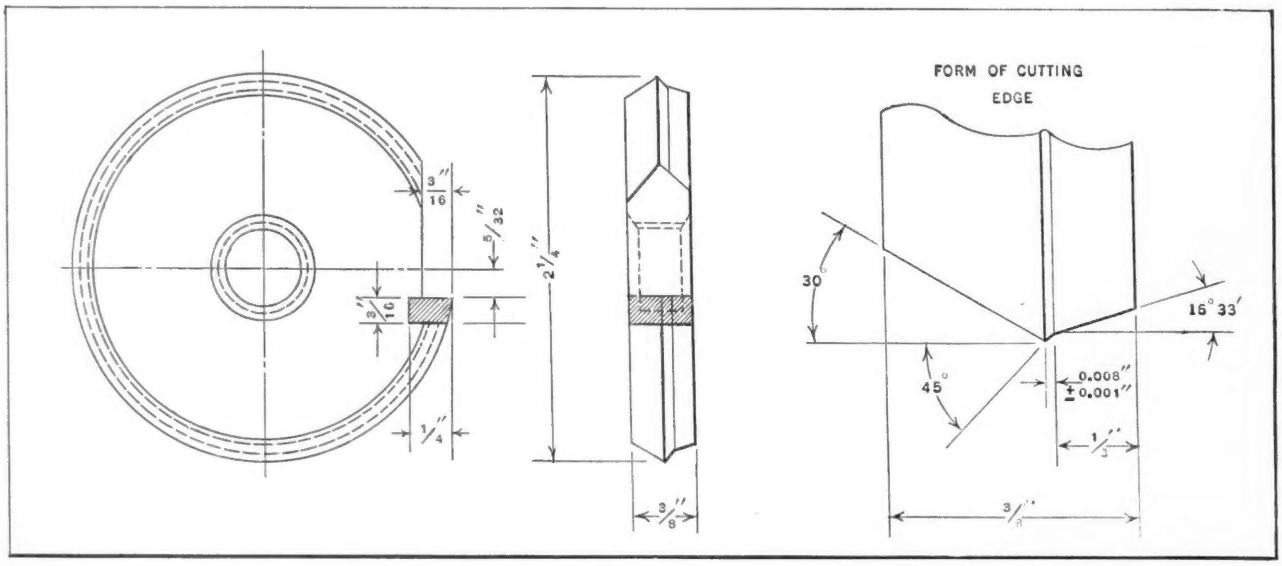


Fig. 2. Forming Tool Designed for Shaping Hard Rubber

After the tools have been ground to shape and size, the keen smooth cutting edges are obtained by lapping. This operation is accomplished on a re-

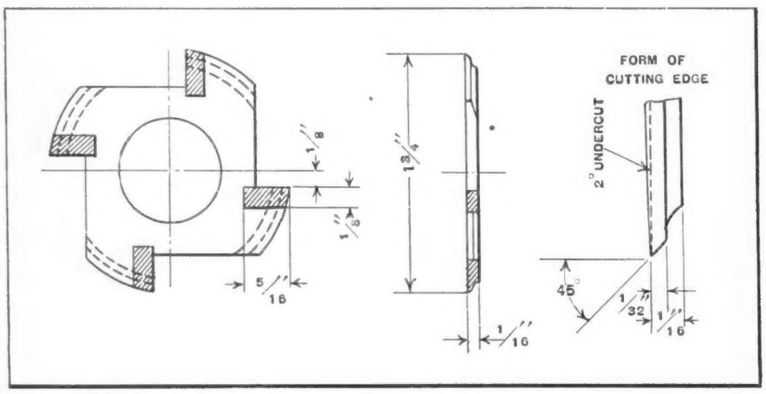


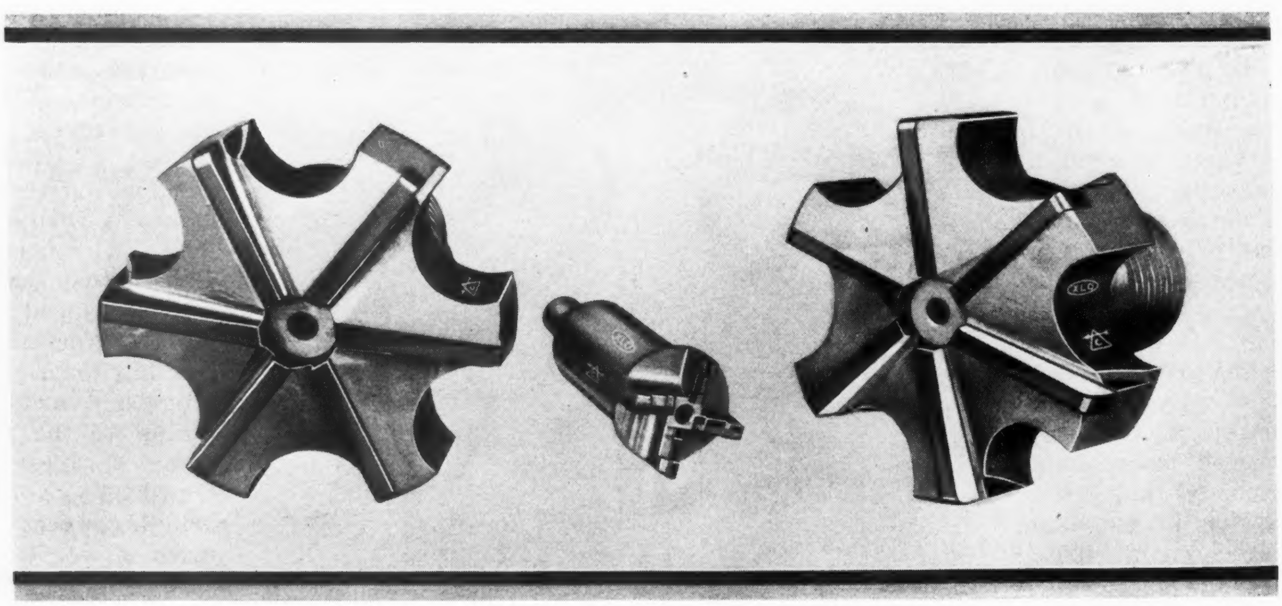
Fig. 3. A Carboloy-tipped Cut-off Tool 1/16 Inch Thick

volving cast-iron disk that is charged with diamond lapping compound.

In the upper left-hand corner of Fig. 1, is shown a cutter that takes counterboring, chamfering, and facing cuts. This tool is approximately 2 1/2 inches in diameter by 1 inch thick and has a 1 1/8-inch hole. It was made for machining cast iron. The Carboloy tips are 3/32 inch thick and extend about one-half the length of the cutter. The faces of the tips lie in true radial planes relative to the cutter axis, and consequently the tips have no rake. The reader will notice the heavy backing furnished for each tip.

In the upper right-hand corner of the same illustration is a circular forming tool of a type made with various shapes of cutting edge for working on hard

Fig. 4. Two Carboloy Counterbores and a Three-stepped Cutter



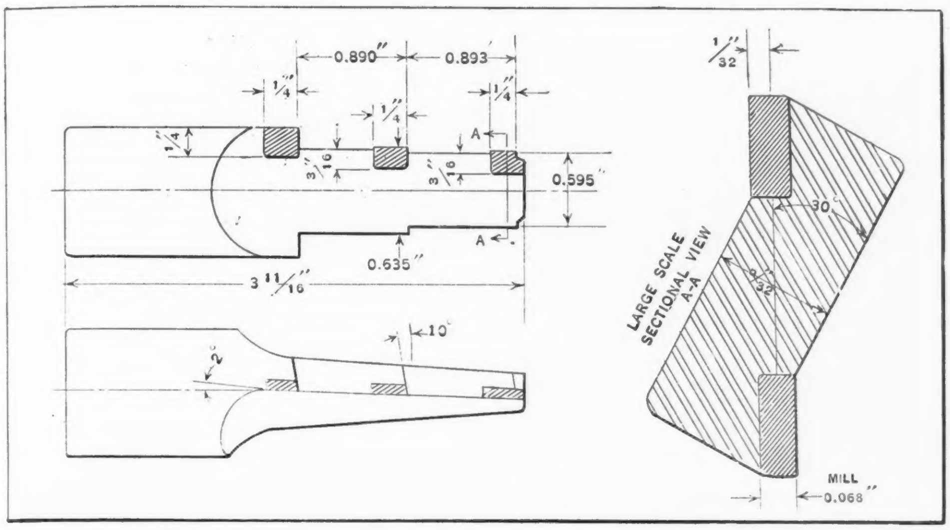


Fig. 5. Boring Tool of Stepped Design for Machining Brass Tubes

rubber. Another example of this type of tool is shown in Fig. 2. From the latter illustration it will be seen that the Carboloy tip (shown shaded) extends the width of the cutter. It is 3/16 inch thick and 1/4 inch deep.

Several examples of combination forming and cutting-off tools, also designed primarily for use on hard rubber, are shown in the lower row of Fig. 1. These cutters are made with three or four Carboloy tips. Cutters of this type have been made as thin as 3/64 inch; the example illustrated in Fig. 3 is 1/16 inch thick. It is provided with four Carboloy tips 1/8 by 5/16 by 1/16 inch.

Cutters used for counterboring the combustion chambers in cast-iron automobile cylinder heads are illustrated at the right and left in Fig. 4. These cutters are 4 inches in diameter within plus 0.0000 inch and minus 0.0005 inch, and are provided with six Carboloy tips measuring 3/16 by 3/8 by 1 5/8 inches. The cutting faces are in planes that are parallel with lines radiating from the center but slightly in advance of the radiating lines. The clearance angle of the tips is 5 degrees. It will be observed that one of the cutters illustrated is of right-hand and the other of left-hand style.

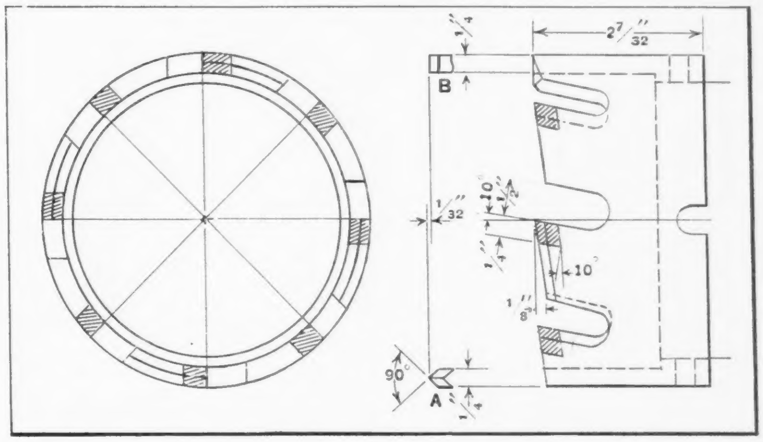
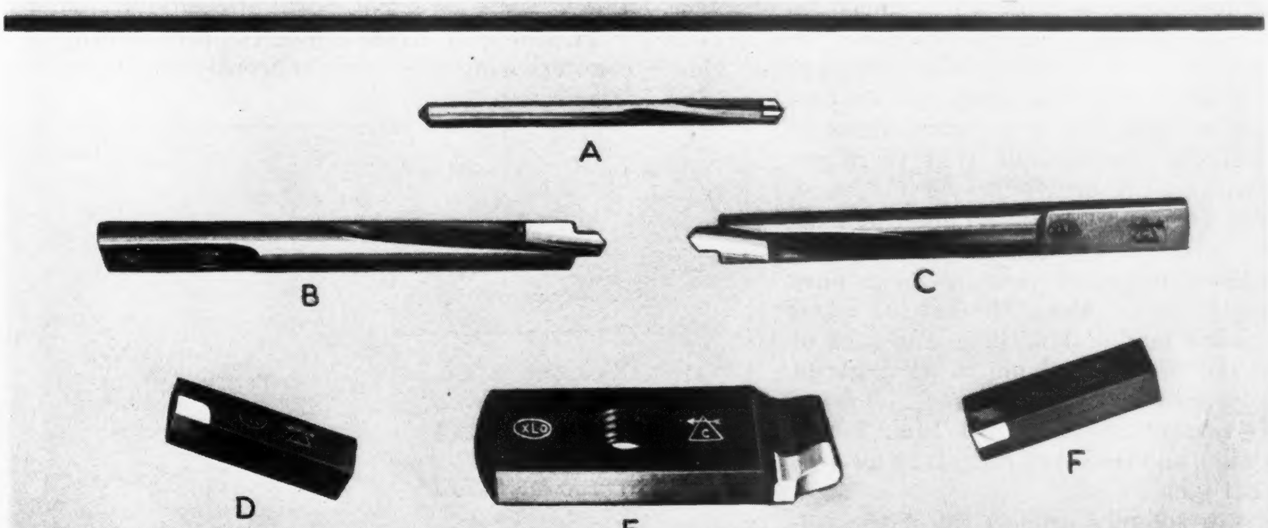


Fig. 6. Hollow-mill with Four V-shaped and Four Flat Teeth

The middle cutter in Fig. 4 is of rather unusual design, having four Carboloy tips of a three-stepped type. This cutter is a combination face mill and

Fig. 7. Various Examples of Tools Provided with Carboloy Tips



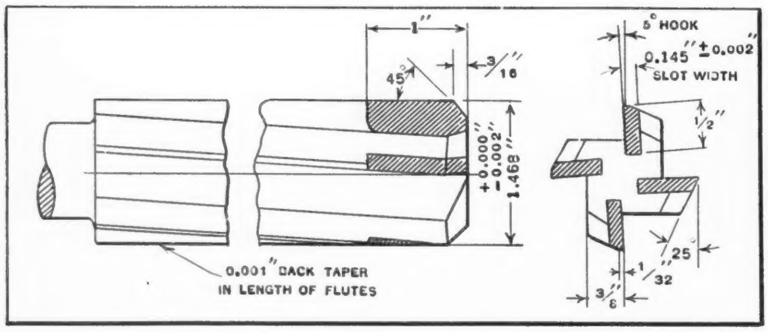


Fig. 8. Details of the Core-drill Illustrated in the Middle of Fig. 9

hollow-mill, being designed for finishing two cylindrical surfaces and three shoulders or faces in one operation.

Brass tubes are bored to two different diameters

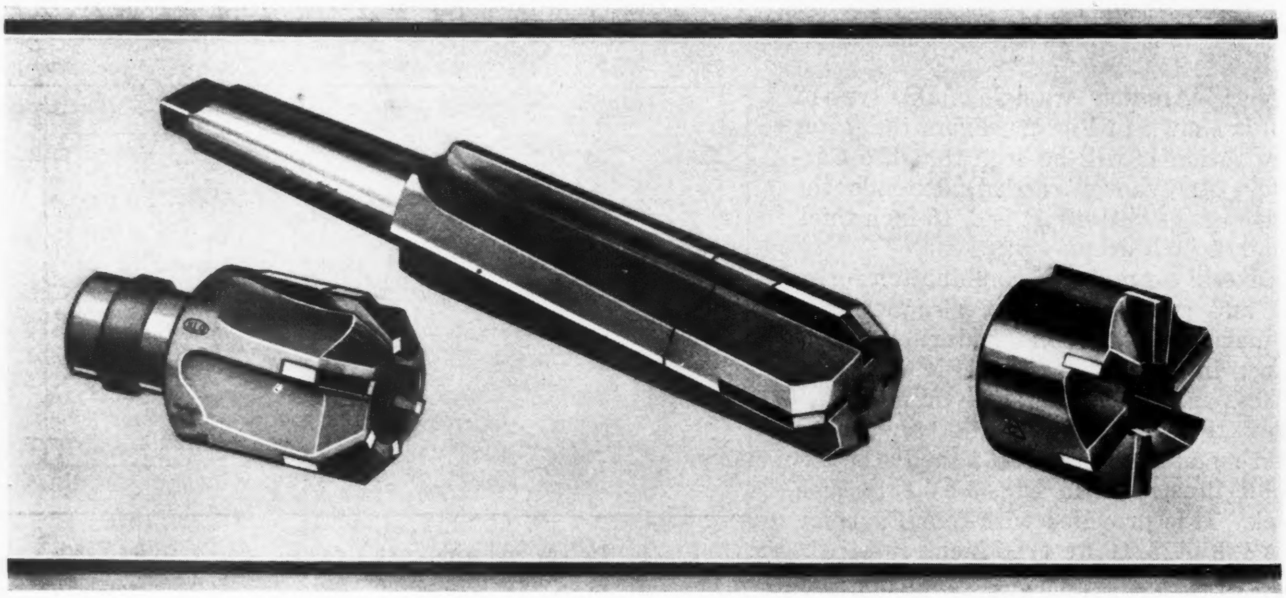


Fig. 9. Chamfering Tool, Core-drill, and Spot-facer which have Proved Especially Satisfactory on Cast Iron

by means of the tool shown in Fig. 5, which also chamfers one internal corner, squares a shoulder, and faces an end. The construction of this tool can best be studied from the enlarged sectional view. It will be seen that Carboloy tips are provided on each side of an approximately rectangular section and that there are six tips altogether.

The tips are placed at an angle of 2 degrees with the center line, as shown in the lower left-hand view, so as to have a slight rake. Along the cutting edges there is a land of 1/32 inch, and back of that the tips are ground to an angle of 10 degrees to provide clearance. Two of the Carboloy tips measure 1/16 by 1/4 by 1/4 inch, and the other four, 1/16 by 3/16 by 1/4 inch.

Every second Carboloy tip of the hollow-mill illustrated in Fig. 6 is V-shaped, as shown at *A*, while the alternate tips are flat, as shown at *B*. It will be observed that the Carboloy tips on this tool have a rake of 10 degrees and that the clearance is made fairly large because of the nature of the cut. The tool was designed for working on cast iron. The Carboloy tips measure 1/4 by 3/8 by 1/4 inch. This tool is part of an assembly that drills and taps a very large hole in cast iron.

Twist Drills with Carboloy Inserts

Twist drills with Carboloy inserts have been made in various sizes up to 1 1/4 inches in diameter. It is the practice to mill a slot across the drill point in such a way that when the Carboloy insert is brazed in place, the insert will line up with the cutting side of both flutes. On a 5/16-inch drill, the insert would be about 1/16 inch thick and 3/8 inch deep. At *A*, Fig. 7, is shown a small drill of this kind.

Two-stepped drills intended for drilling and counterboring holes simultaneously are shown at *B*

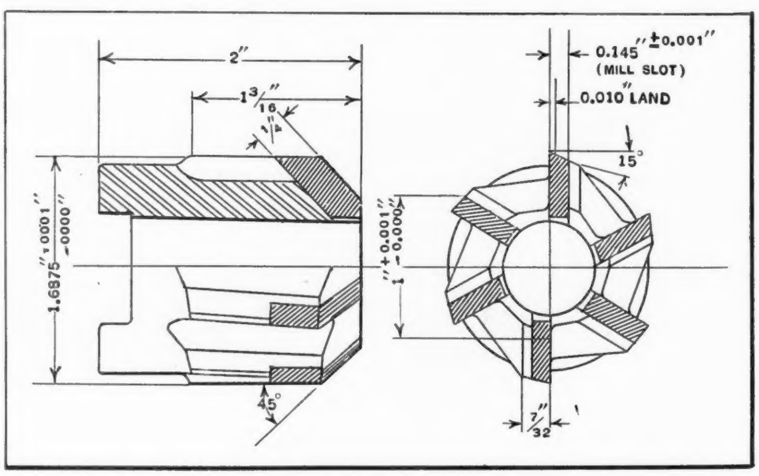


Fig. 10. Shell Drill Used in an Operation on Cylinder Blocks

and *C*, Fig. 7. As in the case of the plain twist drills, a Carboloy insert is brazed in a slot cut across the drill at the cutting end. Drills for the same application, made from high-speed steel, dulled rapidly, but the Carboloy-tipped drills have proved successful because of their long life. Tool *E* in the same illustration is a grooving tool, while *D* and *F* are simple turning tools.

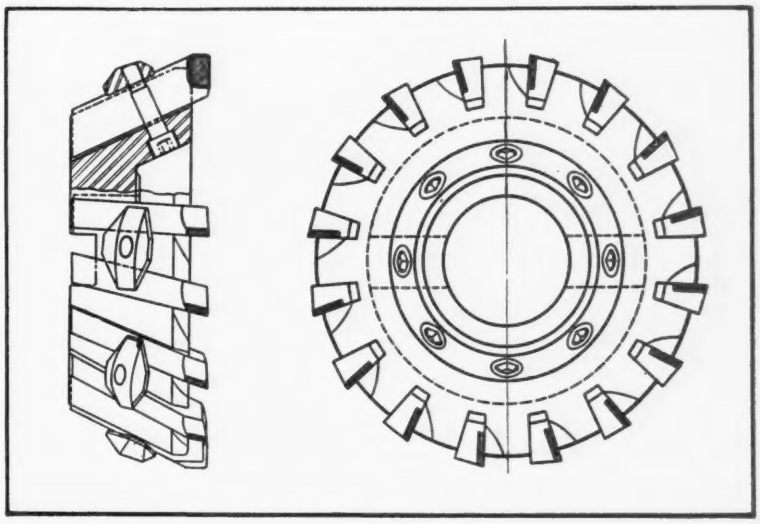


Fig. 11. Milling Cutter with Inserted Carboloy-tipped Blades

Core-drill and Spot-facer

A core-drill of the design shown in Fig. 8 and in the middle of Fig. 9 is made for an operation on automobile cylinder blocks. The Carboloy tips are ground with a rake of 5 degrees. There is a land of 1/32 inch in back of the cutting edges and then a clearance of 25 degrees. The flutes are inclined at an angle of 3 degrees.

At the left in Fig. 9 is a special countersinking tool designed for such operations as machining valve seats and chamfering. The cutter shown at the right in the same illustration is a spot-facer, also designed for use on iron castings.

Fig. 10 shows a shell drill designed for enlarging a hole in another iron casting used in automobile construction. Since the cutting edges are ground to an angle of 45 degrees in order to take a gradual cut at the beginning of the operation, the Carboloy tips are inclined at this angle. The cutting edges of this tool are in a true radial plane with the center line of the cutter. They are ground with a clearance of 15 degrees in back of a 0.010-inch land. The Carboloy tips are 1/8 by 1/4 by 3/4 inch.

Milling Cutter with Carboloy-tipped Inserted Blades

Fig. 11 illustrates a milling cutter provided with sixteen Carboloy-tipped blades inserted in angular slots. To insure rigidity and anchor the blades securely, they are clamped to the body in sets of two by means of studs that extend radially from the inside to the outside of the body. These studs are screwed into clamping pieces so as to tighten them on the outer surfaces of the blades. The construction enables a large number of blades to be accommodated.

The blades project beyond the body somewhat less than high-speed steel blades usually do; this is so that they will have maximum support. Chip clearance is provided in front of each blade by grooves milled in the body.

Fig. 12 illustrates a combination tool used for rough-drilling and reaming holes in one operation. The drilling end has four flutes with Carboloy tips. These tips are ground radial with the center line, and have a land of 1/32 inch back of the cutting edges, with a slight clearance in back of the lands.

Eight Carboloy tips are supplied for the reaming section of the tool. These tips are also ground radial with the center line. There is a land 1/32 inch wide in back of each cutting edge and then clearance at an angle of 15 degrees.

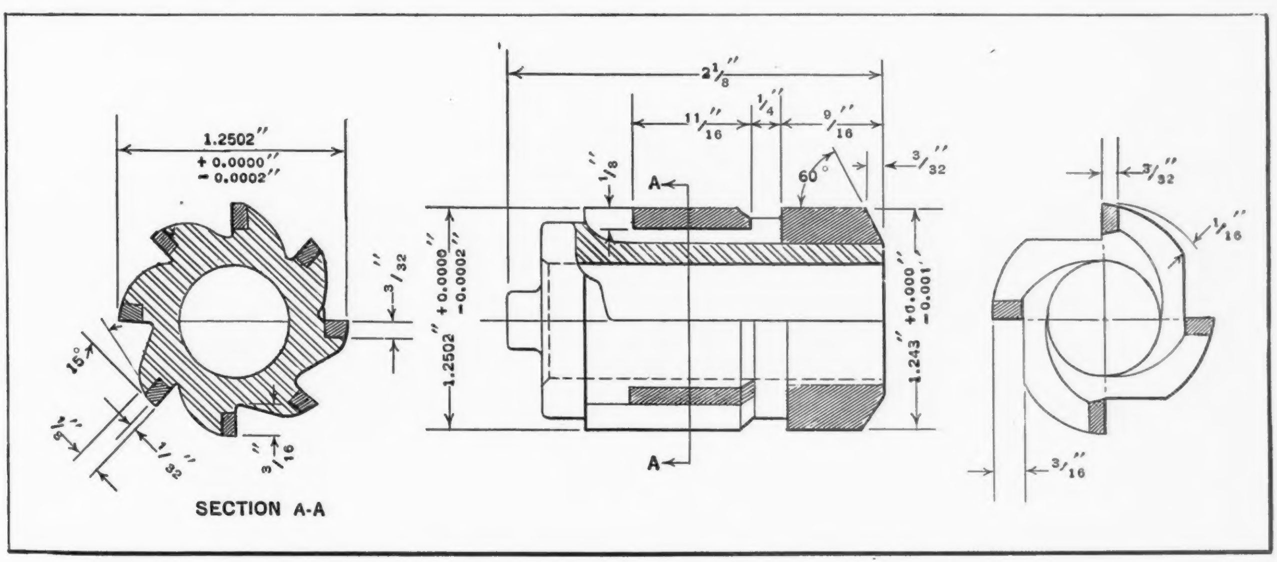


Fig. 12. Combination Tool Provided with Carboloy Tips for Drilling and Reaming Holes in One Operation

Blueprinting Room Planned for Economy

Plans and Equipment of a Blueprinting Department that Enables Two Men to Average More Than 10,000 Blueprints per Month

By E. H. BRUCE, Kearney & Trecker Corporation, Milwaukee, Wis.

TO keep the expense of blueprinting at a minimum, it is essential that suitable equipment be provided and that it be arranged so that the process of making the blueprints can be carried through with as little lost motion as possible. When the Kearney & Trecker Corporation planned its new office building, considerable time was spent in developing efficient lay-outs for each department, especially the engineering section, which occupies the third, or top, floor, and in which a modern blueprinting department is located.

The blueprinting department was arranged around a one-half cylinder, vertical type, blueprinting machine and a horizontal cylindrical dryer. Care was taken to place these two machines so that all orders for prints could be filled promptly and with little lost motion. Space for future expansion was also taken into consideration.

In Fig. 1 is shown a plan view of the blueprint department as finally arranged. The orders for blueprints are delivered to the clerk at station *A*. Blueprint paper, cut to standard sizes and punched for insertion in books, is kept at this station. From station *A* the work goes to the blueprinting machine at *F*, and then to station *B* where the tracings are separated from the blueprint paper in one operation. The operations up to and including this one are performed by one man.

At station *B*, an apprentice from the shop, who

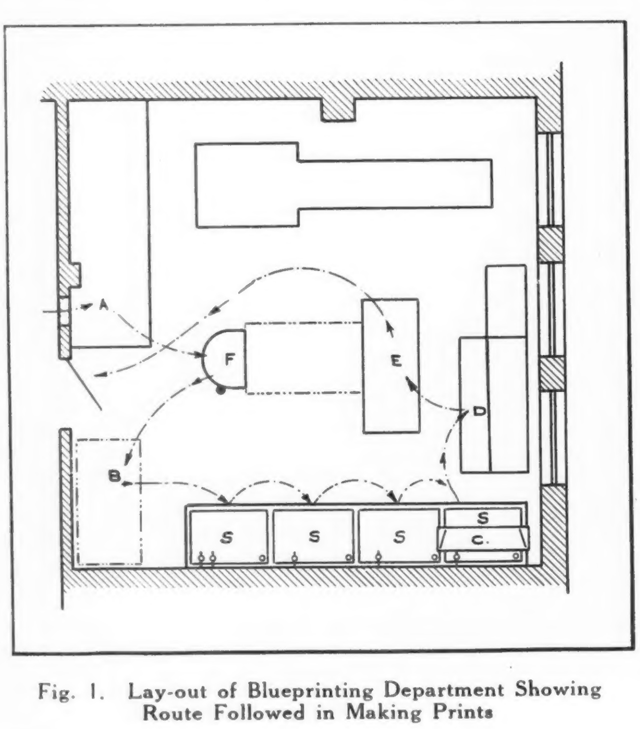


Fig. 1. Lay-out of Blueprinting Department Showing Route Followed in Making Prints

Fig. 2. Removing Water from a Blueprint with a Rubber "Squeegee"

remains in the department two months, washes each print, first in water, then in a solution of potassium. After this, the prints are given two washings in separate sinks. This double washing is given as a precaution against yellow lines or spotted prints. The blueprints are then placed on a drain board *C*, where all excess water is squeezed out with a rubber "squeegee," used in the manner shown in Fig. 2. The "squeegee" is of the type commonly used on marble floors, and is about one foot long. It has a strip of rubber along the lower edge, and may be purchased in most hardware stores.

When the excess water has been squeezed out, the prints go through a drum type dryer located at *D*. They are then dated and sorted at station *E* and delivered to the department by which they were ordered. Particular care has been taken to work out a system that will insure the delivery of reference prints to the proper persons or departments in the shop. With the system employed, all standard tracings that come to the blueprinting department for replacement are automatically printed seven times without a written order. In such cases, the tracings are placed in a basket especially designed and marked for this class of work. A blueprint order blank, shown in Fig. 4, must be filled out for all special prints.

As the drafting department has standardized on one grade of tracing paper, tracing cloth, and blueprint paper, as well as one grade and size of bond paper for typewritten lists, there is no guesswork as to the time required for printing. An accurate record of the supplies used and the size and quan-

tity of prints made each day is kept on the form shown in Fig. 3. Except for the photostat clerk, who spends an hour each morning in delivering the prints to the shop, all the work in the blueprinting department is performed by two people, who have, within the last six months, made an average of 10,930 prints per month. The sizes of the prints are 8 1/2 by 11, 11 by 17 1/2, 17 1/2 by 24, and 36 by 60 inches, the latter size being used for making large lay-outs.

This record was made possible by having a properly designed sink for handling prints up to 36 inches wide, which is the width adopted for blueprint paper. The sink is 14 feet long by 3 feet wide. It is 3 feet high and has four compartments *S*, Fig. 1, each of which measures 40 by 30 by 16 inches on the inside. The first and last sinks are supplied with running water, the circulation of which is maintained by fastening a piece of 3/4-inch brass tubing to the faucet. This tubing is extended to within 2 inches of the bottom in order to avoid splashing.

The regular metal drain spout is replaced by a carefully fitted piece of tubing about 14 inches long, which has several 1/2-inch holes drilled near the top at a point where the water level is to be maintained. This tube is so fitted that it can be removed to allow the sediment that collects on the bottom of the sink to drain off. There is a constant flow of water into the fourth sink which overflows into the third and from there into the drain. This arrangement reduces the amount of water required and keeps the water clear in the fourth sink.

BLUE PRINT RECORD — DATE: [redacted] 929

Day of Month	Photo Rec'd	Photo Used	Carbon Rec'd	Carbon Used	Record of Sheets Rec'd: A Size	B Size	C Size	D Size	Rolls	Record of Each Size Printed: A Size	B Size	C Size	D Size	Double D Size	Total No. of Prints	Accumulated Total
1				2						115	435	28	25	5	608	608
2			85	-	2900			150	½	5	798	6	9	3	821	1429
3																
4		✓		2	1000	2600	250	500		496	59	47	33	2	637	2066
5				2						250	286	20	7	5	568	2634
6				2						647	172	42	28	-	889	3523
7				2		450				20	459	39	33	-	551	4074
8				2						42	586	21	24	-	673	4747
9				-						15	268	21	11	-	315	5062
10																
11		✓		2		3000				8	329	58	23	3	421	5483
12				-						47	326	28	61	1	463	5946
13				2						44	521	23	16	-	604	6550
14				2						213	227	26	14	4	484	7034
15				2						86	162	42	39	-	319	7353
16				-						52	71	29	31	9	192	7545
17																
18		✓		2						156	276	28	7	3	470	8015
19				2						320	65	42	23	7	457	8472
20				-						256	229	32	34	-	551	9023
21				2						145	251	13	38	8	455	9478
22				2	2000	2000		500		124	355	11	12	5	507	9985
23				2						192	57	8	12	3	272	10257
24																
25		✓		2						202	40	4	125	14	385	10642
26				-						172	217	15	14	6	424	11066
27				2			2000	500		158	426	8	4	-	596	11662
28				2						113	265	20	28	6	432	12094
29				-						116	282	20	44	4	466	12560
30				2						172	105	17	6	-	300	12860
31																
TOTAL PER MONTH - ALL SIZES										4166	7257	648	701	88		12860

Fig. 3. Daily Record of Prints Made in the Blueprinting Department

THE BUILDING OF MACHINE TOOLS IN SOVIET RUSSIA

Information published in the industrial reports of the Soviet Union indicate that the plans for building machine tools in Russia are rapidly materializing. Lathes are already being built in large numbers. Representatives of the Soviet Union have opened negotiations with American firms in connection with the building of machine tools in Russia, and similar negotiations were carried to a conclusion with British machine tool manufacturers several months ago.

FORM 132 — BLUE PRINT ORDER

ORDERED BY	DATE ORDERED	NO. OF PRINTS WANTED

RETURN TRACING		DEP'T.	ENG. 1	ENG. 2	JIG	PLANNING	ASSEM. KNEE	ASSEM. MIL.	INSP.
YES	NO	BOOK PRINTS							
		LOOSE PRINTS							

Fig. 4. Form Used in Ordering Blueprints

At that time, a contract for $3,000,000 was placed with leading British machine tool builders for the necessary machine tool equipment for plants of this kind. This equipment, it is understood, is to be delivered before October 31, this year. Liberal credit terms are said to have been given by the British machine tool builders, who have further agreed to provide the Soviet industries with engineering assistance in building their machine tool plants and placing them in operation. Leading British machine tool builders have visited Moscow in order to establish direct contact with the representative industrial and mercantile organizations in Russia. It is stated that if this business had not been placed in England, it would have gone to Germany.

* * *

COMPLETELY LEAKPROOF WORM REDUCER

The problem of entirely eliminating oil leakage in vertical speed reducers has always been a difficult one. Foote Bros. Gear & Machine Co., Chicago, Ill., has brought out a new vertical leakproof worm-gear reducer intended for use in plants where the slightest leakage of oil would contaminate or damage the product, as, for example, in the chemical, paint, and food industries. The design of this worm-gear reducer is a radical departure from established methods of controlling oil leakage. Briefly, the design provides for two chambers within the housing, one in which the worm-gear operates, and the other in which the vertical shaft rotates free from contact with oil at all points.

Machining Sixty-five Pieces Per Minute

Multiple-spindle Screw Machine Equipped with Non-indexing Headstock and a Complete Set of Tools for Each of the Four Spindles

By R. L. BARTLETT

IN order to satisfy the demand for extremely high production of the part shown in Fig. 3, a five-spindle automatic screw machine was arranged with a special non-indexing, four-spindle headstock so that four parts could be produced in one cycle. This machine is shown in Fig. 1. Special means were provided for feeding the 3/8-inch diameter brass bar stock used through the spindles. Four sets of tools, operated by the standard cams, were mounted in a suitable manner for drilling, counterboring, forming, knurling, and cutting off the finished piece.

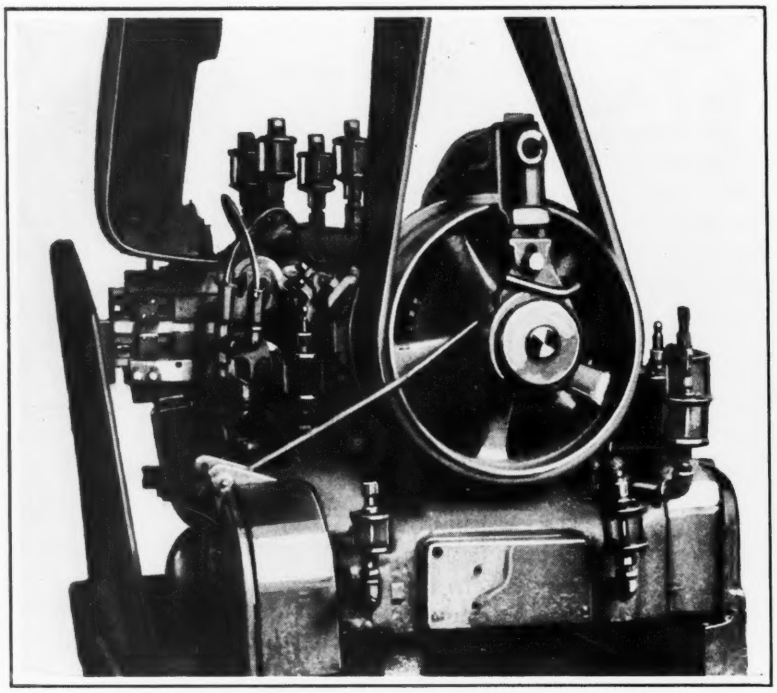


Fig. 1. Screw Machine Arranged to Machine Four Parts at One Time

Standard Headstock Replaced by One of Special Design

As the spindle carrier was not required to be indexed, the headstock, with the indexing gear, was removed from the machine and replaced by another headstock designed to carry four of the spindles from the regular headstock in roller bearings. The brackets on which the forming-tool slides are mounted are secured to the

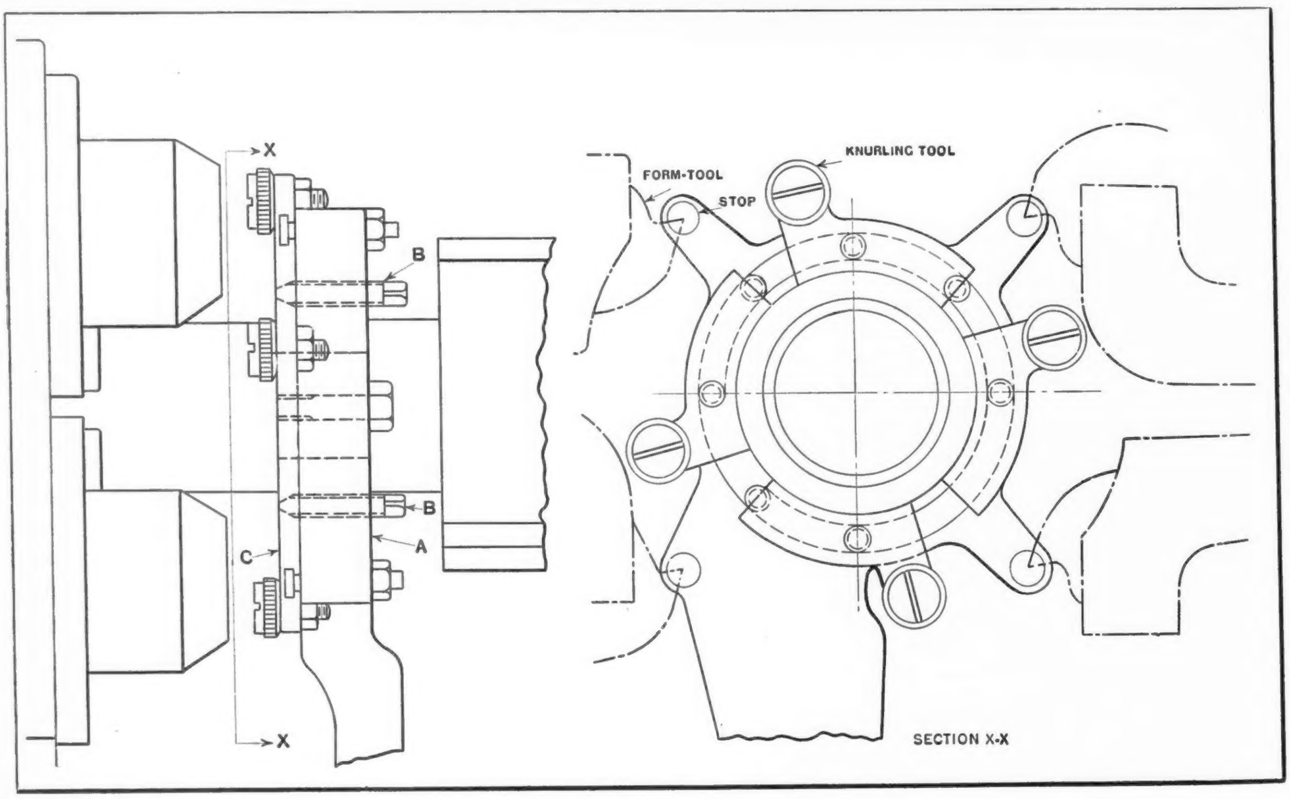


Fig. 2. Cam-oscillated Ring which Carries the Stops and Knurls

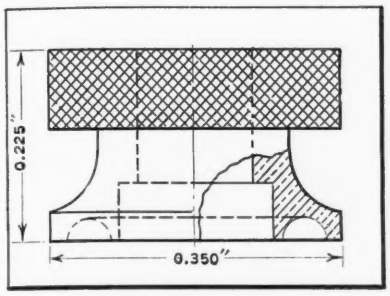


Fig. 3. Brass Knob Made in Machine Shown in Fig. 1

machine in place of the front and rear cross-slides, as shown in Fig. 4.

The feeding movement of these slides is effected by means of the two rocker arms *A*, the upper ends of which engage slots in the slides, while the lower ends engage the standard cams on the machine. It will be seen that this arrangement gives automatic control of all four forming tools.

As shown in Fig. 5, the collets and pusher tubes for feeding the bar stock are operated by the spider *A*. The spider is mounted centrally on the drive spindle *C*, and is operated through the levers *B* by means of the cams on the standard collet-closing and feed cam-drum. Integral with the spider are four forks, which engage the spindles so that the opening of the collets and the feeding up of the bar stock in all spindles are accomplished simultaneously.

Cam-actuated Holder for Stops and Knurls

Mounted on the center of the drive spindle is a ring plate which carries the four bar stops and knurling tools. This arrangement is shown at *A* in Fig. 2. These tools are operated by a cam on the cam spindle, which oscillates the ring at the required intervals to bring the stops into line with the spindle centers and then swing them away and carry the knurling tools to the work. The conical-pointed set-screws *B* provide for adjusting the knurls to the proper depth in the work. By loosening one of these screws and tightening the other, the ring *C* is rotated on the main ring *A*. The

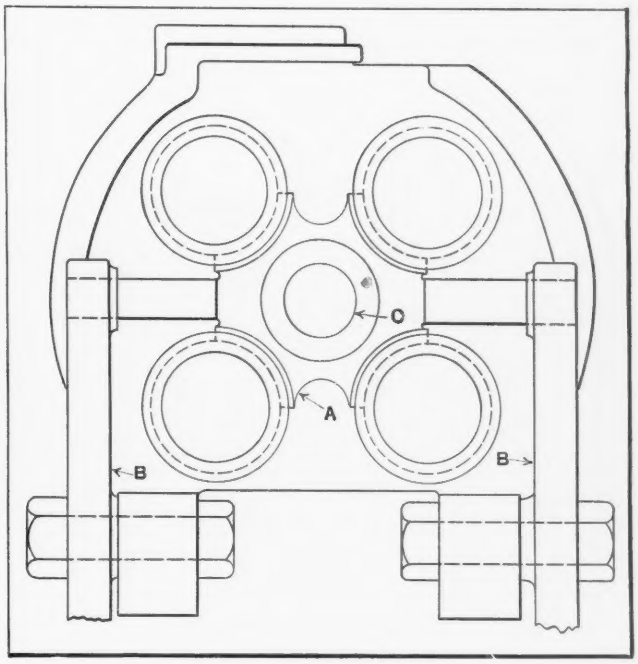


Fig. 5. Cam-operated Spider at Rear of Headstock for Operating Collets and Pusher Tubes

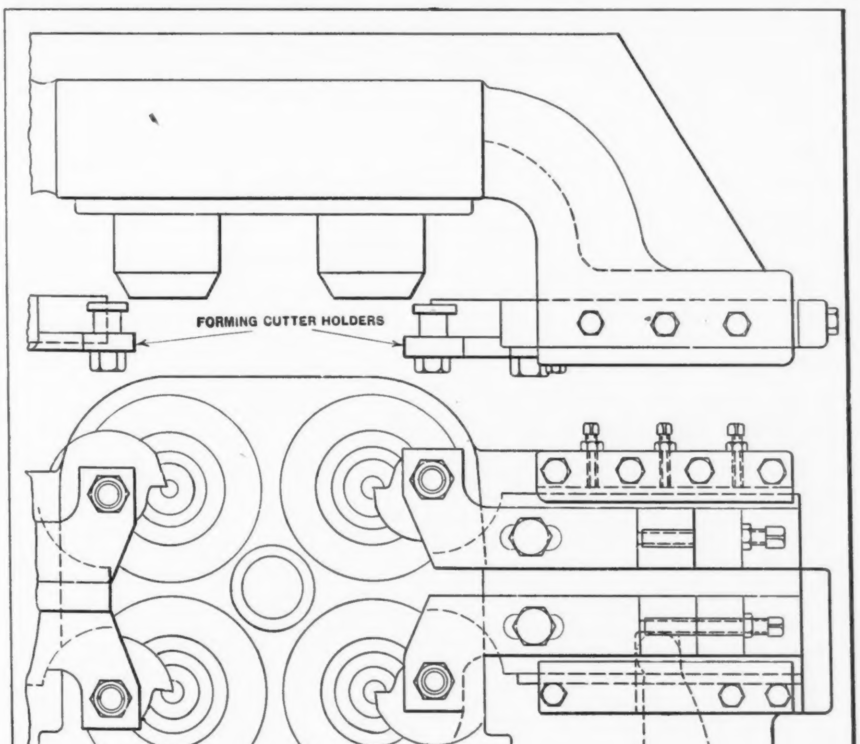


Fig. 4. Arrangement of Forming Tool Slides for Machining Part Shown in Fig. 3

forming-tool slides mounted on the cross-slide bases at the front and rear of the head carry two forming tools which are fed into the work, passing between the collets and the ring plate *A*. This may be clearly seen in Fig. 6.

In operation, the bar stock is fed up to the stop mounted on the ring plate, and the collets are closed. The ring plate then swings away to allow the drills and counterboring tools on the turret tool-slide to feed into the work and the knurling tools to be brought into position. After the knurling operation, the forming tools on the cross-slide feed in and form the outside of the parts. It will be noted that one side of each forming tool is shaped to serve as a cutting-off tool after the parts have been formed to the correct depth.

A spindle speed of 2400 revolutions per minute is employed for this job and a production of 35,000 pieces per nine-hour day is obtained. This is equivalent to the production obtained from the four machines formerly used. This ma-

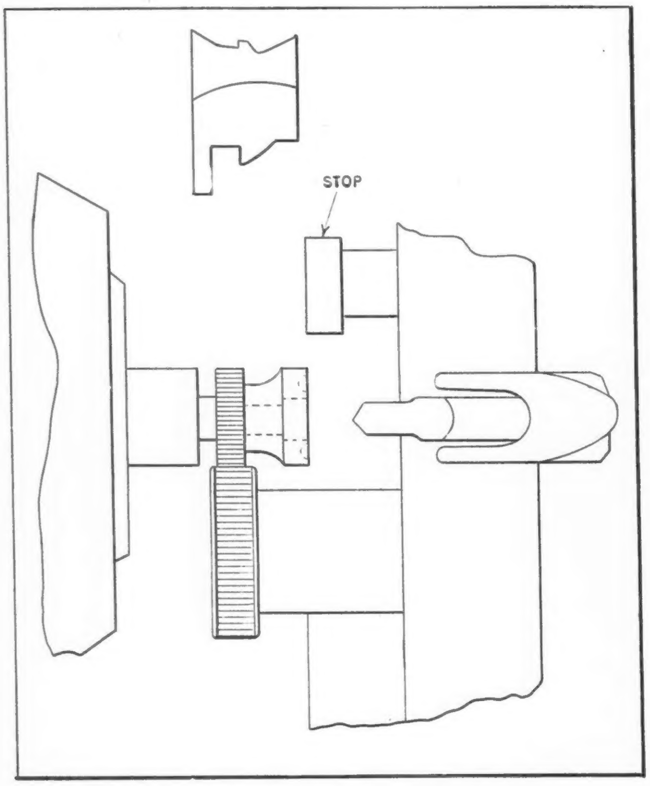


Fig. 6. Diagrammatic View, Showing the Relative Positions of One Set of Tools

chine, arranged as described, could be easily adapted to any screw machine product requiring simple tooling or operations that may be completed at one spindle position.

* * *

THE PLATING AND CLEANING OF ZINC DIE-CASTINGS

Some interesting information on the plating and cleaning of zinc-base die-castings preparatory to plating was given in a paper read before the annual meeting of the Society of Automotive Engineers at Detroit, January 19 to 23, by Robert M. Curts of the New Jersey Zinc Co., New York City. Mr. Curts stated that zinc-base die-castings can be plated with no more difficulty than other commonly used metals. The technique and solutions employed differ somewhat from those used in plating brass and steel, but the process is no more expensive, and the results are quite satisfactory. Recent laboratory investigations, supplemented by commercial experience, have resulted in a simplified plating procedure, which will produce dense, adherent coatings that are comparable to those obtained on brass and steel.

In general, it has been found advisable to plate the zinc article first with nickel. If this procedure is followed, the application of subsequent finishes, such as chromium, copper, silver, and gold, can be carried out in the usual way. It is possible to apply a fairly satisfactory chromium plate directly on zinc, but, usually, this requires considerable polishing to obtain a bright plate, and great care must be exercised to avoid cutting through to the zinc base, which, being quite like the chromium in color, is difficult to recognize until it has had time to tarnish.

Die-castings that have been produced in properly designed dies possess a very smooth fine-grained surface, which is readily buffed with a free-cutting tripoli on the ordinary loose stitched cloth wheel.

Cleaning Die-castings Preparatory to Plating

Cleaning is perhaps the most important of all operations, because improper cleaning will result in pitting, blistering, and flaky coatings. Of the numerous cleaning solutions that have been systematically investigated, the following seems most satisfactory: Tri-sodium phosphate (6 ounces per gallon of water) used boiling hot as an electro-cleaner with the articles as the cathode and with sufficient current to cause gassing. Moore suggests the addition of sodium hydroxide (1 ounce per gallon) and sodium cyanide (1 ounce per gallon) to this solution. In any event, care must be taken to avoid appreciable amounts of strong alkalies or cyanides, as these promote the formation of dark films on the zinc pieces, which interfere with the adherence of the primary coat.

The use of an acid dip to etch the surface slightly and improve adherence is common practice. Either a weak solution of hydrochloric acid, 10 per cent by volume, or a 1 per cent solution of hydrofluoric acid may be used. Usually a dip of thirty to sixty seconds is sufficient, after which the castings or fabricated zinc pieces are rinsed in cold water. They are then ready for the plating bath.

Enameling, Japanning, and Lacquering Die-castings

When necessary, it is possible to apply attractive coats of enamels, japans, and lacquers to zinc and zinc alloys. Care should be taken not to use too high a temperature in the baking of enamels and japans, in order to avoid undesirable changes in the physical properties of the casting or rolled zinc part. Special lacquers are being investigated which may prove to have advantages over the ones now in use.

* * *

THE FOUNDRY CONVENTION IN CHICAGO

The convention of the American Foundrymen's Association to be held May 4 to 7 at the Hotel Stevens, Chicago, Ill., has been planned with a view to providing greater exhibit space, a broader program of papers, and better meeting-room facilities than were available at the 1929 meeting in Chicago. One new feature will be a session on problems relating to patternmaking; increasing attention is being given to pattern production by foundrymen throughout the country. Another innovation in the 1931 program will be a course on sand control and on malleable foundry practice. The general sessions will cover foundry costs and apprentice training, in addition to the subjects mentioned.

Accurate Boring and Threading Operations

THE hydraulic shock absorbers made by the Spicer Mfg. Co., Toledo, Ohio, embody a reservoir part on which boring cuts are taken to an unusual degree of precision. The rough reservoir forging is shown at the left in Fig. 1, and a partially finished reservoir at the right.

Identical rough- and finish-boring operations are performed in separate lathes for finishing the internal surfaces of this part. In the finishing operation, knob *A* is machined to a diameter between 0.5625 and 0.5635 inch; surface *B* to a diameter between 2.562 and 2.564 inches; and surface *C* to a diameter between 2.808 and 2.809 inches. Bottom surface *D* must be at right angles to the bored surfaces within close limits, and the length of surface *B* must be between 0.8759 and 0.8764 inch. Shoulder *E* is finished in the same operation.

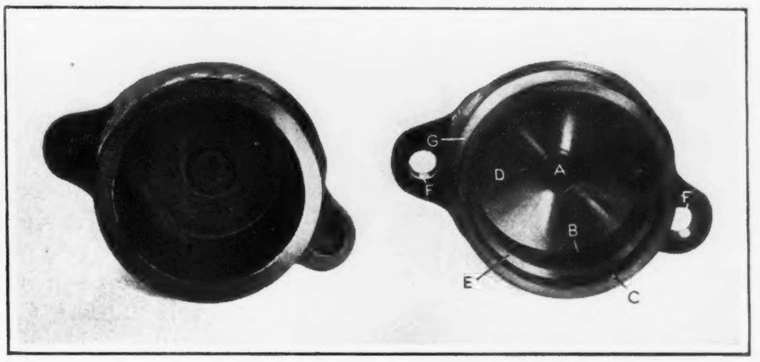


Fig. 1. Rough and Machined Reservoir Forging for Shock Absorbers

The Equipment Used for Boring

Fig. 2 shows the equipment used in performing the boring operations. Accuracy is insured through the use of a sturdy fixture which holds the work as shown at *H* and also guides the 2.8745-inch tool-spindle *K*. The bearings in which the tool-spindle is piloted are about 4 1/2 inches long. A flexible coupling connects the tool-spindle with the headstock spindle.

In taking the cuts, the carriage is advanced to bring the work to the tool. The type of tool employed may be seen at *L*. It will be noted that the side cutting edges of this tool are stepped so that surfaces *B* and *C*, Fig. 1, and shoulder *E* between them are finished by the same tool. Face *D* is machined by the end cutting edges. The cutter is of the solid type.

The part is located for the operation by seating the two reamed holes *F* over dowel-pins on the fixture. Two fingers *M*, Fig. 2, which are clamped on opposite sides of the part by means of a quick-acting device, hold the part securely in place. The fillet that joins surfaces *D* and *B*, Fig. 1, is removed by placing the part over tool *N* and turning it by hand.

A Pilot Guides the Die-head Used in Cutting the External Threads

Threads are cut on the outside surface *G* of the reservoir with a Rickert-Shafer automatic self-opening die-head on a single-spindle drilling machine, as illustrated in Fig. 3. One of the features of this operation that insures concentricity of the threads with the internal bores of the part is the

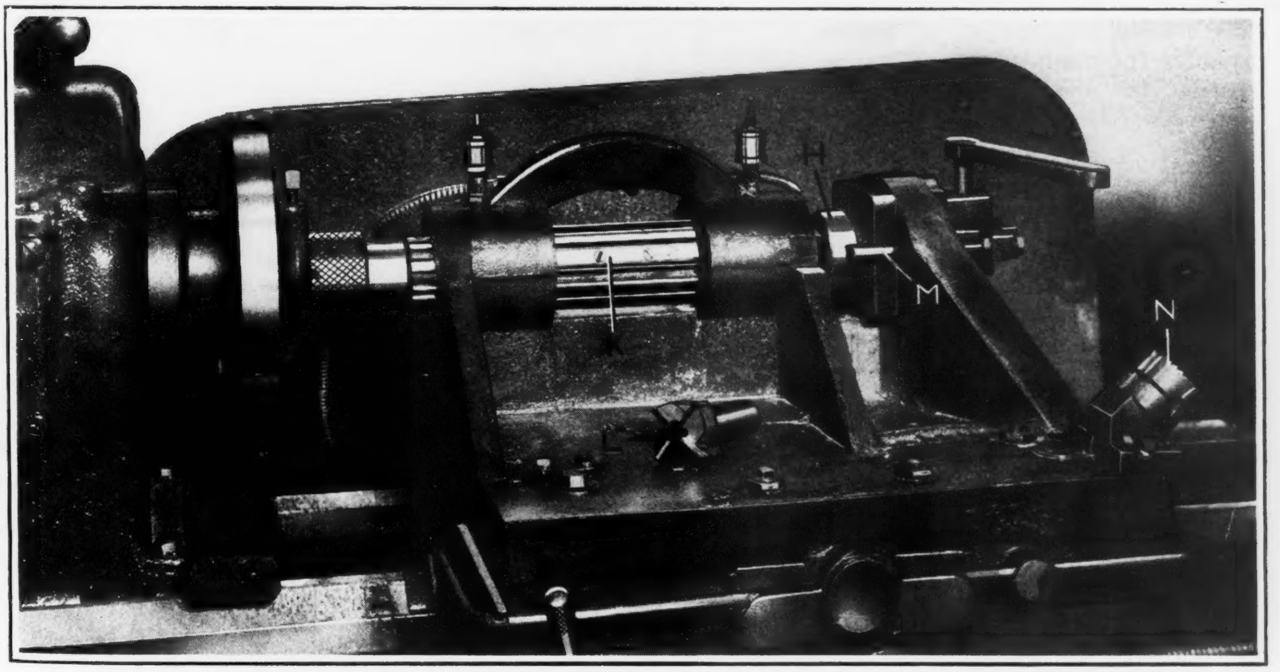


Fig. 2. Equipment Used for Boring and Facing the Internal Surfaces of the Shock Absorber Reservoir

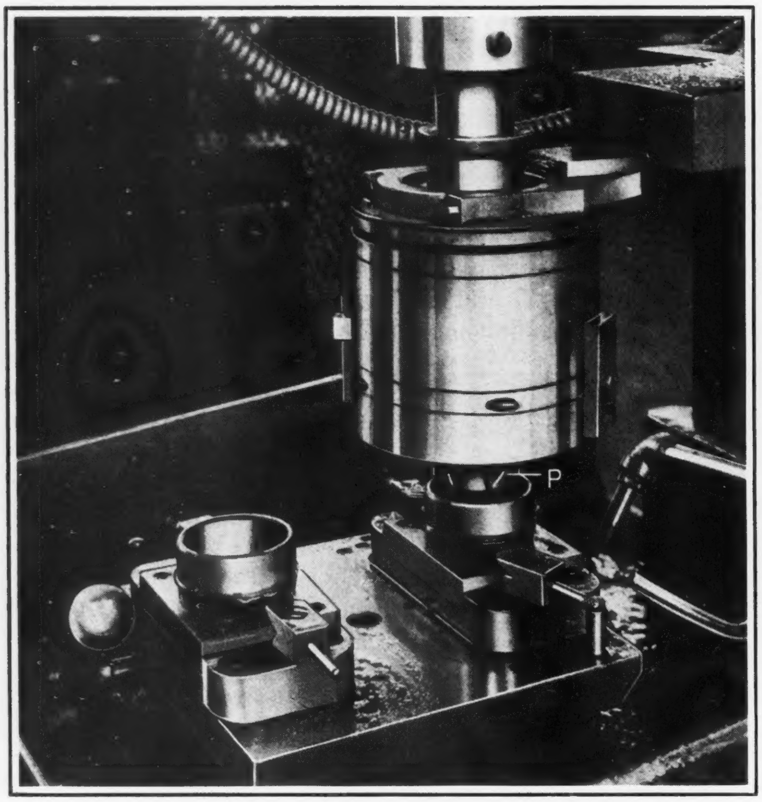


Fig. 3. Piloted Die-head Employed for Cutting the External Threads on the Shock Absorber Reservoir

use of a pilot P that registers with surface B, Fig. 1. The die-head has a floating connection to the machine spindle. The threads are 3 3/16 inches outside diameter, 18 per inch, and of U. S. or American (National) form; they are cut to a width of 7/8 inch.

The production averages 120 parts per hour. One of the factors in attaining this high rate is the use of two work-holding fixtures, mounted on one slide. While a piece in one fixture is being threaded, work can be loaded into the second fixture ready to be slid under the die-head when the operation in process has been completed.

* * *

AIDING MANUFACTURERS IN FINDING DISTRIBUTORS

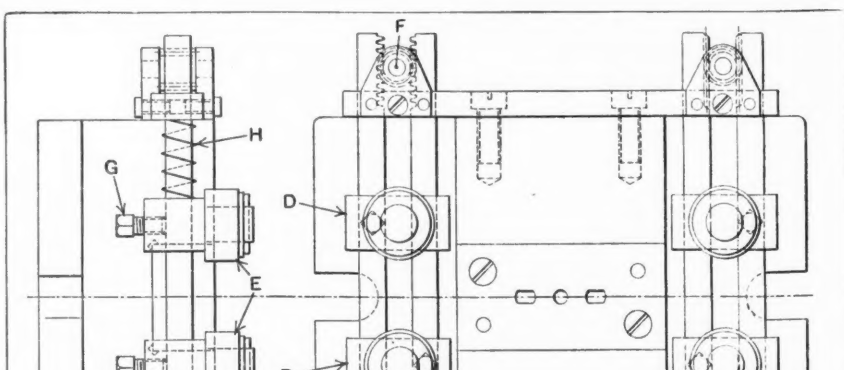
The Philadelphia Bourse, Philadelphia, Pa., is making plans to have its machinery department act as a clearing house or connect- shop equipment manufacturers and distributors in the Philadelphia territory. Machinery and shop equipment manufacturers who are seeking representation in the Philadelphia market are invited to address the Machinery Exhibition and Sales Department of the Philadelphia Bourse. This organization will aid manufacturers in finding representatives.

STRIPPER PLATE FOR CENTRALIZING STRIP STOCK

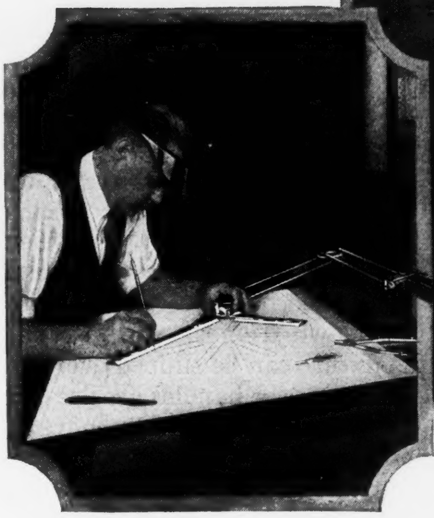
In blanking safety razor blades, it is common practice in one plant to first pierce all the holes in the strip, using the usual roll feed arrangement, after which the strip is rewound into a coil to facilitate the subsequent blanking operation. Thus it is possible to locate the perforated strip very accurately for the blanking operation by having guide pins enter the pierced holes.

However, if uniformity is to be obtained, allowance must be made for slight variations in the strip width, as it is essential that the pierced holes be exactly central with the edges of the strip. To obtain this result, the stripper plate shown in the illustration was designed. Attached to the bolster A are two mild steel strips B, bored at each end to provide a sliding fit for the four circular bars C. On bars C are mounted the blocks D which, in turn, carry the rollers E to guide the strip. At the outer end of each sliding bar C are machined a number of rack teeth which mesh with the pinions F.

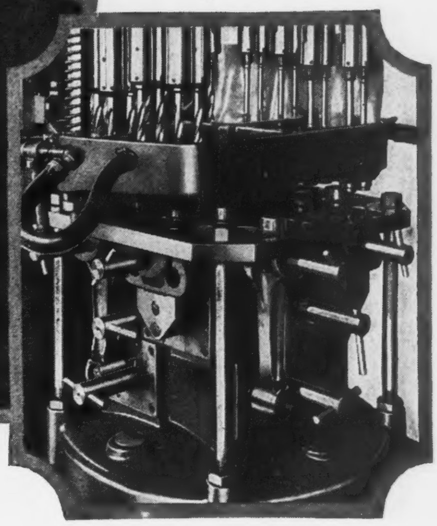
It will be obvious that any lateral movement of one of the bars C will be accompanied by a movement in the opposite direction of the bar with which it is connected. Inasmuch as the blocks D are clamped to the opposing bars by screws G, it follows that the rollers, and consequently the stock, are always kept central with the die. Coil springs, as shown in the end view at H, are mounted on the sliding bars at each end, and serve to keep the rollers in contact with the edges of the stock. The small triggers J attached to two of the bars enable the operator to separate the guide rolls when feeding in a new strip.



Blanking Die Equipped with Device for Centralizing Strip Stock



Design of Tools and Fixtures



SPINDLE FOR SMALL GRINDING WHEELS

By F. J. WILHELM, Dayton, Ohio

Trouble encountered in holding grinding wheels as small as 1/8 inch in diameter while grinding very small holes in dies, jigs, and fixtures resulted in the design of the spindle here illustrated. The grinding wheel *B* was of such unusually small size that it was impossible to hold it on a regular grinding spindle. With the design shown, however, wheels as small as 3/32 inch in diameter can be held securely while in operation.

A common pin passes through the wheel and into the hollow spindle at *H* until it enters a hole drilled through the flat sliding block *C*. The pin is clamped in this block by means of the two screws *D*. Both outside edges of block *C* are threaded and engage corresponding threads cut inside the knurled nut *E*, the latter turning freely on the shank of the holder.

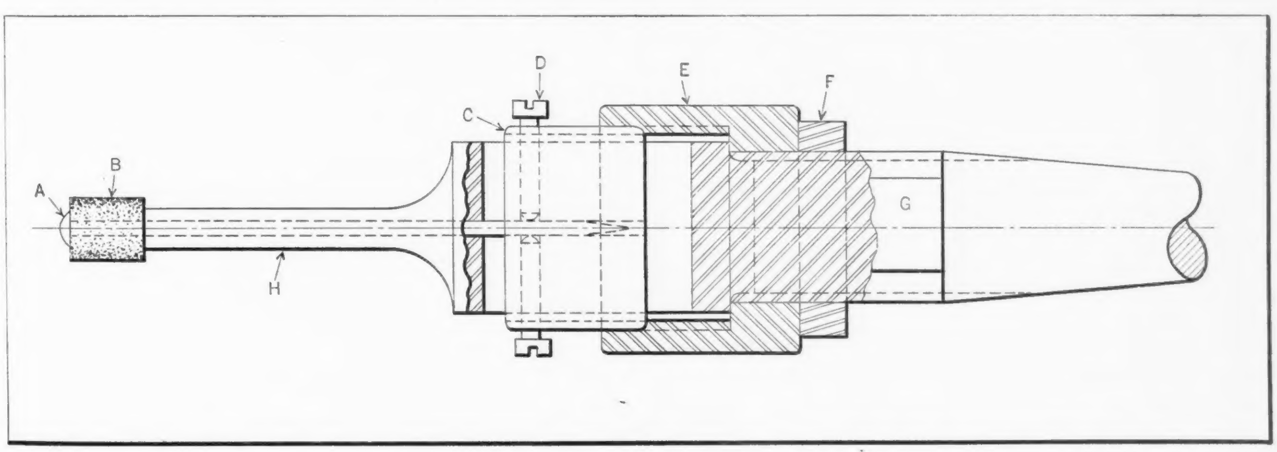
To secure the wheel against the left-hand end of the spindle *H*, the nut *E* is turned until the block *C* and pin *A* are carried to the right far enough to force the pin-head against the face of the wheel. The check-nut *F* is then screwed tightly against nut *E* to maintain the setting during the grinding operation. In order to facilitate the mounting of the wheels on the spindle, the chuck shank is flattened off at *G* to fit a wrench. The right-hand end of the spindle is tapered to suit the hole in the grinding machine spindle.

A STAMPING FIXTURE HAVING INTERCHANGEABLE STAMPS

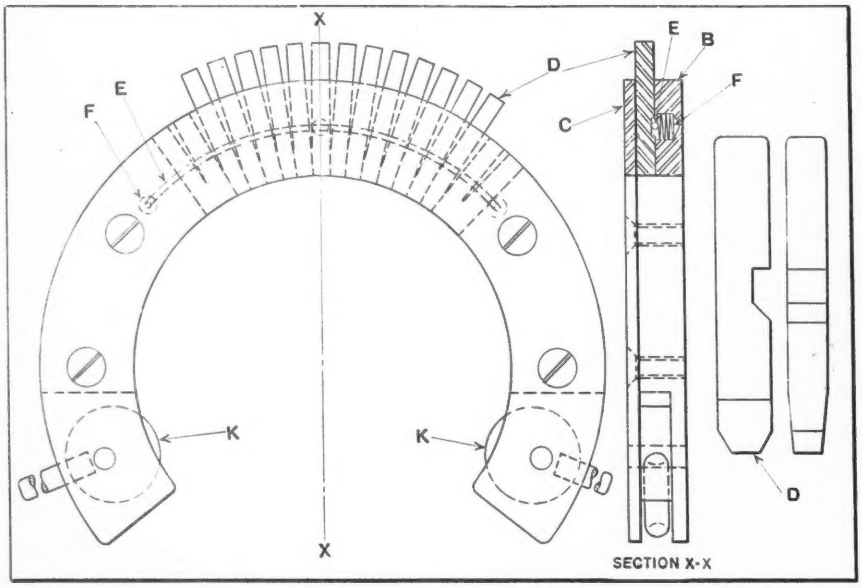
By P. H. WHITE, St. Louis, Mo.

For some classes of round work on which serial numbers or other marks are to be stamped, satisfactory results are not always obtained with separate stamps because of the difficulty of lining up the characters uniformly by the eye; and since one or more of the characters must be changed for every piece, the cost of a full set of solid stamps would be prohibitive.

To overcome these difficulties, the writer designed a stamping fixture capable of holding several single stamps in proper alignment, and which also permits them to be easily changed when required.



Grinding Spindle on which Wheels as Small as 3/32 Inch in Diameter are Mounted



Fixture in which Interchangeable Stamps are Kept in Correct Alignment

This fixture has been used for marking from 200 to 300 pieces per day for several months, and has performed its work satisfactorily.

As shown in the illustration, it is made in the form of a segment of a circular ring, and has an inside diameter slightly larger than the outside diameter of the work. In the center section of the face of the body *B* are milled a number of radial slots which are a sliding fit for the stamps, the latter being ground on their sides to a uniform width and thickness.

The stamps are confined by the cover plate *C*, and are narrowed slightly toward the ends to prevent interference when they are moved in toward the center. As shown in the enlarged view at *D*, the stamps are notched out at the back, with the upper side of the notch square and the lower side having a 45-degree bevel.

In the face of the body and midway between the outer and inner circumferences, a groove is turned concentric with the ring section and having a depth somewhat greater than the diameter of the spring wire *E*. At the extremities of this groove and at the central point holes are drilled in which the short coil springs *F* are seated. The spring wire *E* is formed to fit the groove without binding, and the two ends are bent back at right angles to the plane of the curve, so that they extend down into the center of the two end springs *F*.

Thus the spring wire *E* acts as a retainer to hold the stamps from dropping out of the fixture, while the three coil springs push the segment of wire forward into the notches in the back of the stamps. The square side of the notch catches on the wire, preventing the stamps from being pushed through the fixture. When it is necessary to change a stamp, it is simply pulled out of the fixture, and a new one inserted in its place. When a stamp is being removed, the sloping face of the notch comes in contact with the wire and forces it back into the groove so that the stamp can be removed.

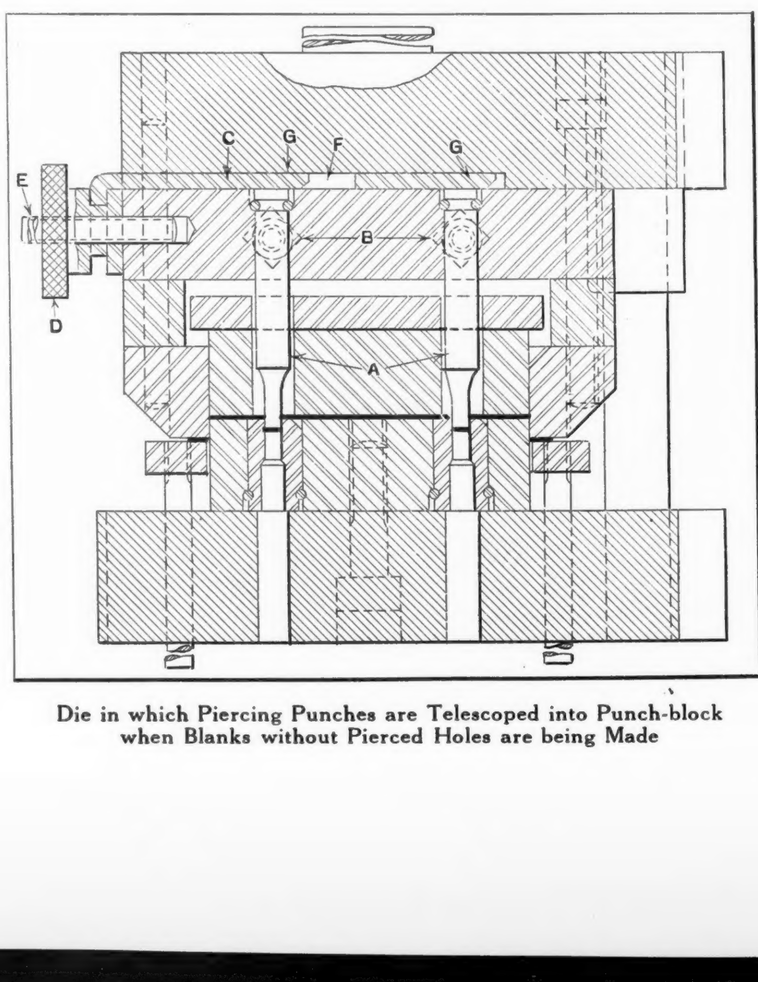
Provision is made for clamping the fixture to the work by means of the two eccentrics *K*. When the handles on these eccentrics are raised, the eccentrics are withdrawn from the work so that the fixture can be slipped over the end. When the handles are pressed downward, the eccentrics move in and lock the fixture in place. A light tap with a hammer on each of the stamps produces the required marking on the piece.

DEVICE FOR RENDERING PIERCING PUNCHES INOPERATIVE

By JOE MARSHALL, Philadelphia, Pa.

In order to use the same die for blanking two pieces that are identical except that one contains pierced holes while the other has none, the die shown in the illustration was designed. The die itself is of standard construction, but the provision made for raising the punches so that they will not operate when making the blanks that have no pierced holes is rather novel.

The piercing punches *A* are secured in the punch-block by the set-screws *B*. In the illustration, they



Die in which Piercing Punches are Telescoped into Punch-block when Blanks without Pierced Holes are being Made

are shown in position for piercing the holes in the blank, the thrust of the punches being taken by the slide *C*. In making the blanks requiring no pierced holes, the slide *C* is moved to the left by means of the hand-nut *D* on the screw *E*, the latter being screwed tightly in the punch-block. The feeding movement transmitted by the hand-nut carries the opening *F* in the slide directly over the end of the punch at the left; while at the right, the end of the slide clears the other punch.

Set-screws *B* are now loosened and the punches pushed upward until they come in contact with the punch-holder at *G*, after which the set-screws are again tightened. Thus the punches are raised high enough not to enter the blank when the punch-holder descends. This arrangement is considered superior to that of removing the punches altogether from the die, as the set-up is not disturbed in changing over from one piece to the other; and since the change can be made rapidly, little time is lost.

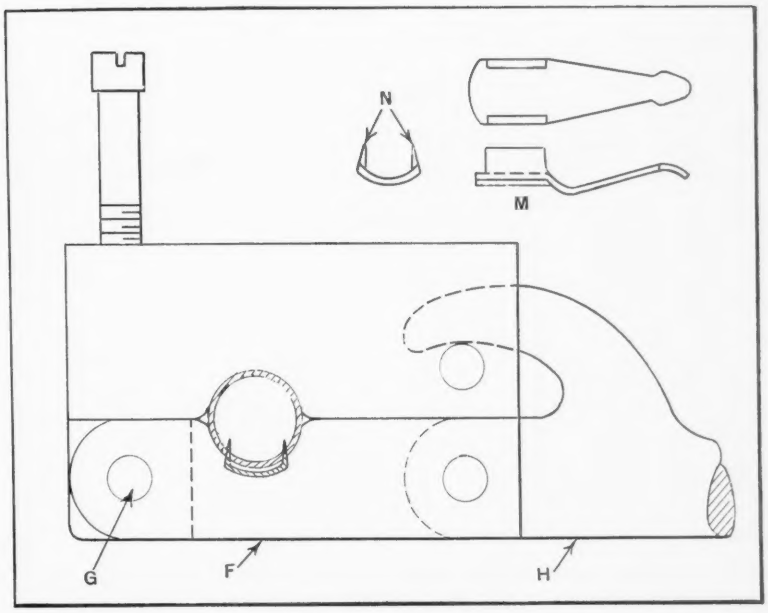


Fig. 1. Fixture for Holding Pencil Clips Assembled in Hand Press

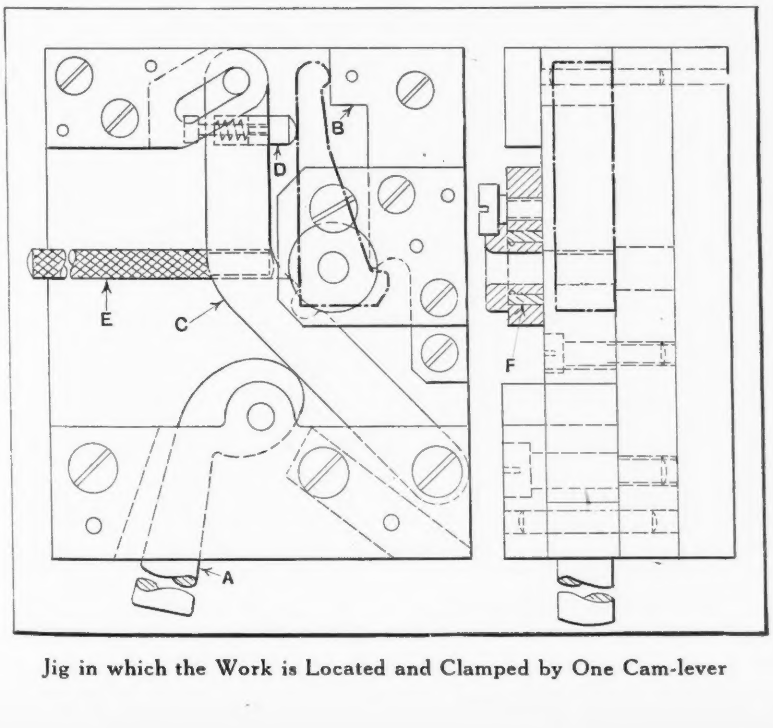
JIG WITH QUICK-ACTING CLAMPING DEVICE

By W. N. DELENK, Cleveland, Ohio

In the illustration is shown a jig used for drilling and reaming clutch fingers for automatic lathe chucks. A finger is clamped in the jig at two points by means of the cam-lever *A*. It is forced against the locating block *B* as the cam-lever is swung to the left. This motion of the lever forces the arm *C* to the right and clamps the work securely.

A spring-actuated plunger *D* in one end of the arm serves to force the small end of the finger against the block *B* in order to locate the finger correctly in the jig before the clamping action takes place. The drill guide bushing *F* is a drive fit in a plate mounted on the locating block *B*, slip bushings being used for drilling and reaming.

To unload the jig, the lever *A* is swung to the right. This releases the arm *C* from the work, and the arm is then swung to the left by handle *E*, so that the work can be removed.



Jig in which the Work is Located and Clamped by One Cam-lever

HAND FIXTURE FOR ASSEMBLING PENCIL CLIPS

By D. A. BAKER, Long Island City, N. Y.

On one type of mechanical pencil, the clips are assembled without the use of solder; at the same time no projections are permitted to extend beyond the inner surface of the pencil barrel. In order to maintain this condition, the clips were designed as shown at *M* in Fig. 1. The ends *N* for attaching the clip to the barrel, are cold-swaged to a thin edge and inserted through slots punched in the pencil barrel. To turn the points inward and flatten them flush with the inside of the barrel, the fixture illustrated in Fig. 2 was designed.

This fixture consists of the cast-iron frame *A*, a round plunger *B* having rack teeth cut on one side which engage a pinion on the shaft *C*, and punch *J*. Shaft *C* is operated by means of the hand-lever *D*. To the front of the frame is attached a work-holder *E* having a swinging leaf *F* hinged at *G* and locked with a cam-lever *H* when closed on the work. The action of this holder is more clearly illustrated in Fig. 1. Here is shown the leaf cut out to form a nest for the clip, while the

work-holder is also cut out to the contour of the pencil barrel.

It will be seen from Fig. 2 that punch *J* has a tapered groove *K* milled in it; as the punch is forced down into the pencil barrel, the groove causes the ends of the clip to be bent as required. The gradual taper of the punch from the point up was necessary, as it was found by experiment that a steeper one would shear off the ends of the clips.

It will be noticed from the enlarged view of the work-holder in Fig. 1 that enough clearance was provided in the holder so that the clip was allowed some play between the outside of the barrel and the leaf. This construction permits the barrel to be forced out against the clip, thus providing enough space so that the ends of the clip can be made smooth and flush with the inside of the barrel.

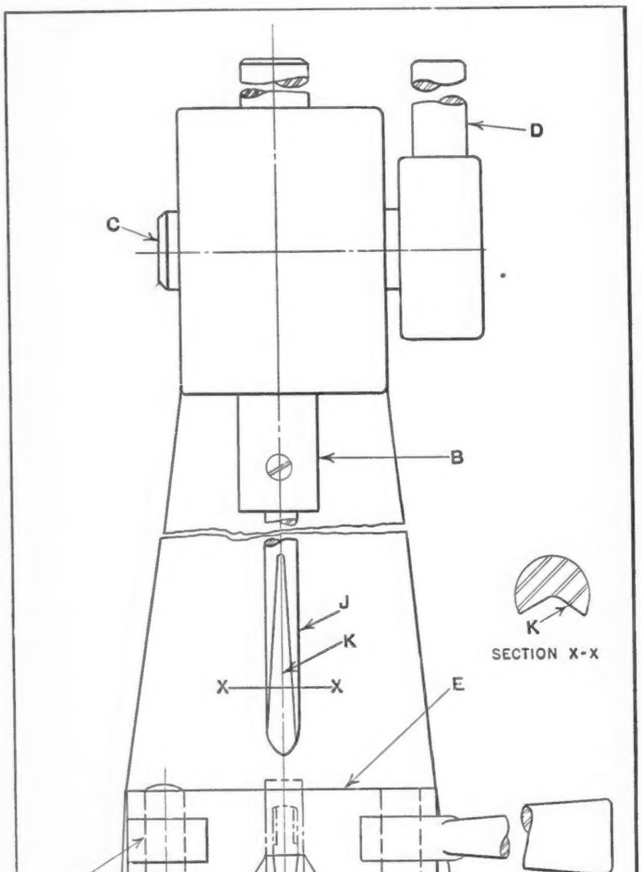
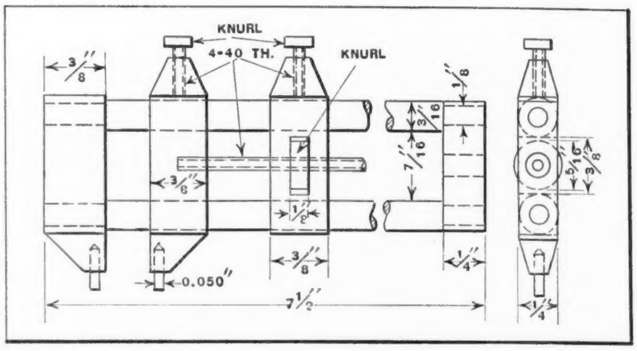


Fig. 2. Hand Press for Assembling Clip Shown in Fig. 1 to Pencil Barrel



Adjustable Gage for Measuring Center Distances between Small Holes

GAGE FOR CHECKING CENTER DISTANCES OF DIE HOLES

By SEYMOUR SCHREITER, Scotia, N. Y.

The gage shown in the illustration was found to be very handy for checking the distances between the holes in piercing dies when the holes were of small size. Checking these distances with standard plugs is more accurate, but in cases where a large number of small odd-sized holes are to be measured, a gage of the type shown will save the cost of making up small measuring plugs.

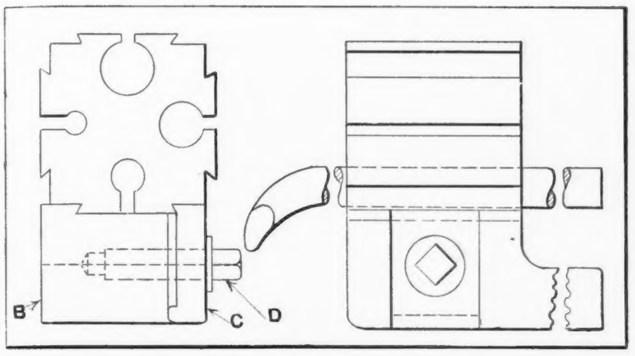
This gage is somewhat similar to a slide caliper, although its construction is much more economical. The heads and the sliding members are made of ground stock, while the bar on which the sliding members operate is made of drill rod, the ends being turned down to fit the heads. Two small pins, 0.050 inch in diameter, are driven into one of the solid heads and its adjacent sliding head. These pins serve as the measuring points, and when in use, their sides are set to slide against the adjacent sides of the two holes being measured.

Direct measurement is then taken by means of a micrometer over the outside of the pins, the diameter of the pins being subtracted to obtain the center distance between the holes. The general dimensions of this gage are given to aid anyone who may wish to make one for his own use, although it may be more convenient to make it larger or smaller according to the class of work being done.

HOLDER FOR BORING-BARS OF VARIOUS DIAMETERS

By H. L. WHEELER, Syracuse, N. Y.

In the illustration is shown a holder in which boring-bars of various diameters can be clamped. The holder consists of a square block of machine steel which is dovetailed on each of its four sides. These dovetails fit corresponding openings in the lower member *B*. The bar is placed in the hole nearest the lower member, and is clamped in this position by the strap *C* and the screw *D*. As the screw is turned, the strap exerts a pressure against one side of the dovetail and closes the hole a sufficient amount to clamp the bar securely.



Boring Tool Holder in which Bars Having Shanks of Different Diameters can be Held

When a bar having a shank of different diameter is to be used, all that is necessary is to unclamp the block and rotate it so that the correct sized hole will be brought into position next to member *B*, after which the bar is clamped as previously described. It is obvious that the boring-bar can be quickly removed for sharpening and reset to its original position without disturbing the tool-holder. The holes in the block should be of standard sizes to fit the common sizes of drill rod from which boring-bars are usually made.

FIXTURE FOR TAPPING NUTS HAVING A ONE-INCH LEAD

By O. E. CHARLES, Rochester, N. Y.

Nuts having a 1-inch lead and triple threads of special form are tapped in the fixture shown in the illustration. This fixture is used in an upright drill press, and the tap is fed through the nut, in a positive manner, by a lead-screw actuated by a train of gears driven from the machine spindle.

The fixture is located in the center of the machine table by the bushing *B*. The tapered shank of the driving pinion *C* fits into the drill press spindle, the pinion meshing with the friction gear *D* mounted on the sleeve *E*. This sleeve drives the lead-screw *F*, which is provided with a double spline that is engaged by two keys in the sleeve *E*. The lead-screw has the same lead as the nut to be tapped, and when the sleeve rotates, it turns this screw in the bronze nut *G*.

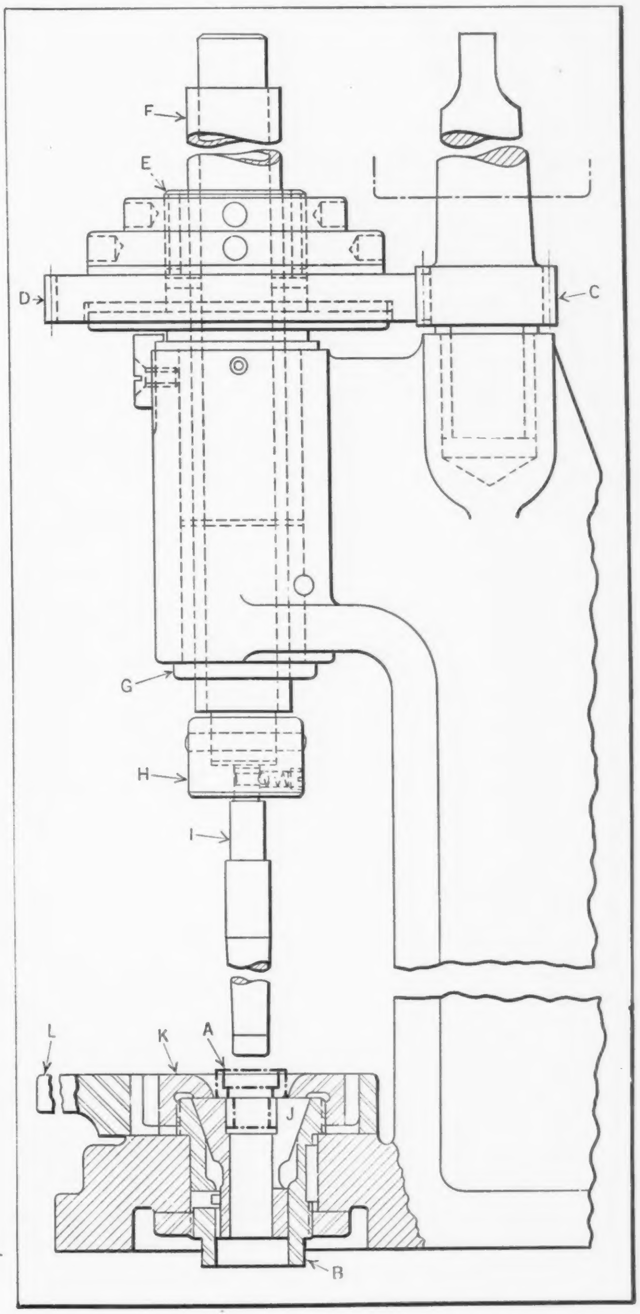
A square hole in the driver *H*, secured to the lower end of the lead-screw, serves as a socket for the tap shank *I*; the latter is held in place by means of a spring-actuated ball which engages a depression in the side of the shank. The tap is tapered to within 1 inch of the upper end, while the lower end is provided with a pilot which fits the hole in the nut to be tapped.

Where it is found necessary to pass more than one tap through the nut, the squares on all the tap shanks used must be accurately milled or ground in correct relation to the lead of the thread.

The nut is secured in the spring collet *J* by turning the nut *K* with the wrench *L*. Nut *K* has eight splines to correspond with the key in the wrench.

In operation, the nut to be tapped is placed in the spring collet and locked in position, as shown at *A*. The tap is then inserted in the driver *H* and rotated by throwing in the clutch on the drill press. Thus the tap is fed positively through the work true to the lead of the tap. The collet nut is now released and the spindle reversed, causing the tap to feed upward with the nut resting on the top thread of the tap. When the latter has reached its starting position, the operator throws the clutch lever on the machine into neutral, removes the tap from the driver, slips the tapped nut off the tap shank, and replaces the tap.

The writer has made a hand-operated fixture similar to the one described for tapping steel nuts where two taps are used successively. Formerly, six taps were employed in a lathe and the results were not satisfactory.



Fixture in which Tap is Fed in a Positive Manner through the Work

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

NOT long ago I visited a well-known machine shop and walked down the main aisle with the general manager. Machine tools were placed along the bays on each side. We stopped in front of a large planer, 8 by 8 by 20 feet, to which the manager pointed with considerable pride, stating that the machine was fifty-five years old and still doing good work.

It is easily demonstrated that a modern planer would pay for itself in this shop in three years, or give a 33 1/3 per cent return on the investment. It would save approximately $10,000 a year; yet, a small fortune is being thrown away annually by continuing the use of an obsolete machine.

BUD JONES

MACHINERY FOR TRADE SCHOOLS

To buy cheap machine tool equipment for a trade school is a short-sighted policy from two angles—first, cheap tools are worn out quickly when operated by inexperienced boys and men, and second, the learner does not get an opportunity to practice on the kind of machinery that he will find in the better machine shops of the country.

In the state trade schools of Connecticut, machinery of the highest type and quality will invariably be found. The buying of machinery and tools for these trade schools is delegated to men with wide experience in the trade to be taught. Price should be left out of consideration if it interferes with obtaining a particular make or type of machine that will best serve the purpose. Manufacturers can render a service to their communities by impressing this fact on their local school boards.

WILLIAM C. BETZ

HOW MUCH EDUCATION SHOULD THE EMPLOYER PAY FOR?

Employers often send some members of their organization to night schools to take specific courses that will be of value to them in their work. The cost of instruction is paid for, provided the men attend the courses faithfully.

In one plant lately, the men in the shop told the management that some of them would like to attend night classes, and they felt that inasmuch as the employer would eventually benefit by their added training and knowledge, he ought to pay for the instruction. In this case, the employer replied that he was glad to send men to night school and pay their tuition fee, if they occupied some special position with the firm where their added knowledge would be of direct benefit; but he could not see why he should pay the tuition for all employes, as it was really their business to see to it that they obtained additional education if they wanted it.

There were not enough openings for future foremen and superintendents in his plant to take care of all the men who might fit themselves for such positions, and in time, some of these men would seek employment elsewhere. In extending to them financial aid in educating themselves, the employer felt that he would merely help to train men for his competitors.

While it doubtless benefits employers when their men acquire additional knowledge either through courses, books, or trade journals, it is difficult to answer the argument that the employer should not be expected to foot the entire bill.

CHARLES R. WHITEHOUSE

WHEN IS A MACHINE TOOL OBSOLETE?

The article on obsolete machine tools, published in February MACHINERY, page 463, is timely. There has been a great deal of misunderstanding between automobile manufacturers and machine tool builders on this point. When the automobile manufacturer has demanded a machine that would pay for itself in two years, or sometimes in one year, the machine tool builder has thought him unreasonable. He has felt that too great a return was expected on the investment.

The automobile manufacturer, however, has had his reasons. The rapid changes in automobile design and the necessity for using special machines to as great an extent as possible, in order to reduce manufacturing costs, has placed him in a difficult position. He has needed machines of unusual productivity, but it was safe for him to buy these machines only if he could recover his investment in a comparatively short time—short enough so that necessary changes in automobile design would not make the machine obsolete before it had paid for itself. Hence, the automobile manufacturer was justified in expecting a quick return on his investment.

This, however, applies only to machines of a special type. Shop equipment that is practically standard does not become obsolete in one or two years, and should be bought on a basis of paying a fair annual return on the money invested. A reasonable annual depreciation should be charged off on machines of this type.

OBSERVER

Special Equipment for Grinding Flat Surfaces

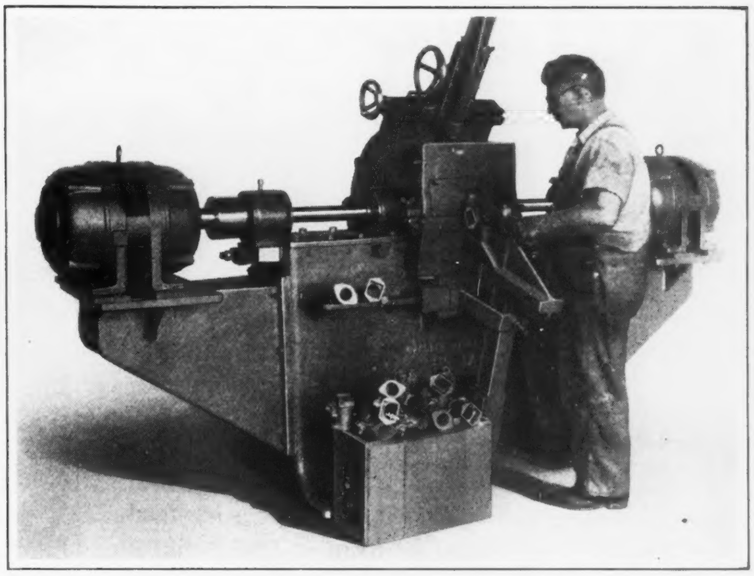


Fig. 1. Two-spindle Hand-fed Machine in which Small Castings are Ground on Both Sides at the Rate of 300 per Hour

Work-carriers and Fixtures Designed to Handle Work on a Quantity Production Basis
Second of Two Articles

By CHARLES O. HERB

WHEN work is to be handled on a quantity production basis, it is generally desirable to use a standard machine equipped with work-holding and feeding devices designed to suit the individual part rather than to use a machine constructed especially for the job. Then if the shape of the part should be radically altered or the operation discontinued, the standard machine could be easily applied to some other job, whereas a special machine might be useless.

The first of these articles, which appeared in February MACHINERY, described several standard grinding machines, built by the Gardner Machine Co., Beloit, Wis., which have been equipped for quantity production service. Other examples along the same line will be given in the present article.

Fig. 1 shows a two-spindle machine provided with a simple hand-operated device for placing the work between the grinding members. When this has been done, the operator depresses a foot-treadle and advances the grinding members to the work. An area of about 4 square inches is ground on each side of the castings, and approximately 1/8 inch of stock is removed over all. The sides of these pieces must be finished parallel and flat within plus or minus 0.003 inch, and the width dimension must be to size within plus or minus 0.003 inch. The production averages 300 pieces per hour.

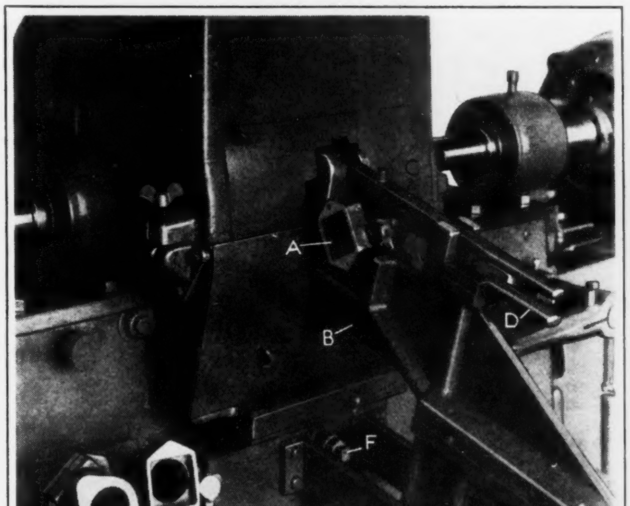


Fig. 2. Attachment that Enables Small Castings to be Loaded Rapidly

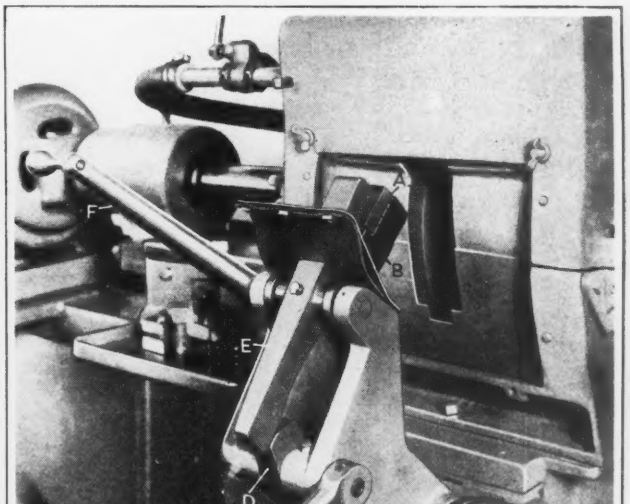


Fig. 3. Work-feeding Device Used in Grinding the Sides of Half-nuts

The method of holding the part is comparatively simple. As shown at *A*, Fig. 2, it is seated in a V-block in bracket *B* and held securely by the headless set-screw in the hinged clamp *C*. After a part has been loaded, the operator lifts the handle formed by the ends of the piece *D* and clamp *C*, thus swinging the work into position between the abrasive members. A counterbalance makes this movement of the work-holding unit easy. Set-screw *E* limits the withdrawn position of the work-holding unit, and set-screw *F* governs the forward position. Grinding disks 20 inches in diameter and 3/8 inch thick are used on this machine.

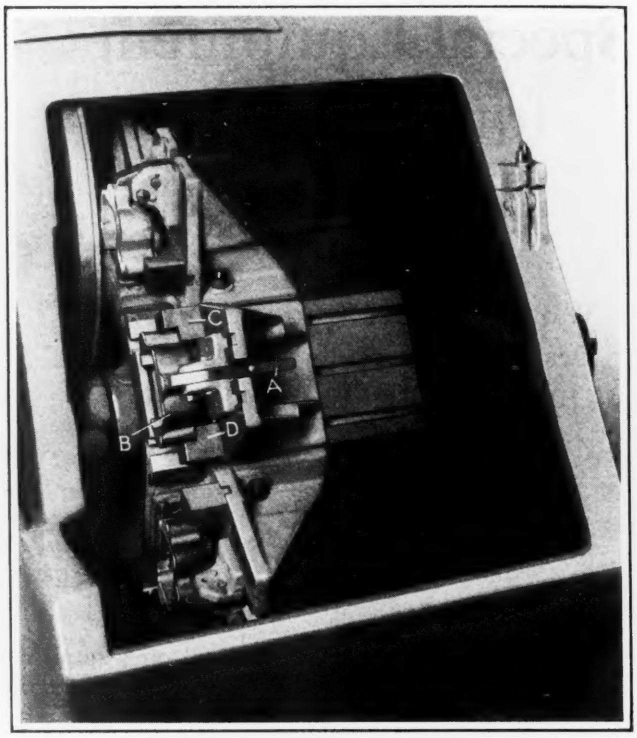


Fig. 5. Quick-acting Hand-operated Clamps Reduce the Loading Time on this Job to a Minimum

Simple Arrangement for Handling Half-nuts

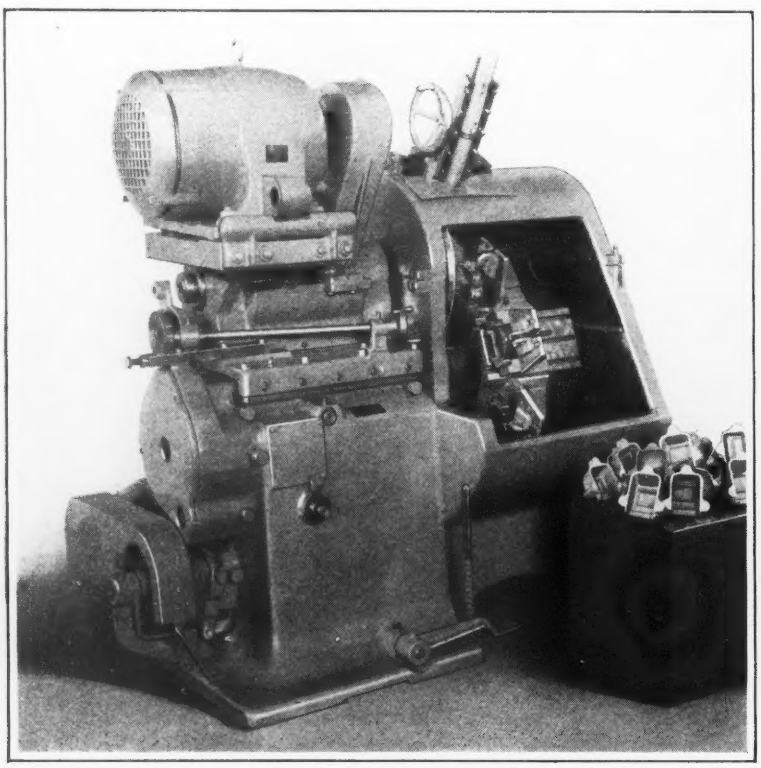
A machine of the same general type as that shown in Fig. 1, but equipped with the work-feeding arrangement illustrated in Fig. 3, was designed for grinding both sides of steering gear half-nuts simultaneously. These pieces are made of steel, and are ground both before and after hardening. The operation before hardening is for the purpose of removing stock so as to bring the piece approximately to size, from 0.007 to 0.010 inch of metal being ground off each side. After the hardening process, from 0.002 to 0.004 inch of stock is removed per side to produce the desired width.

An important requirement of this operation is that the two sides of the work must be parallel with each other within comparatively close limits, and also parallel with the center line through the nut portion. For this reason, the threads of the half-nut are seated, for the grinding operation, on a thread that corresponds with the thread of the worm that the nut must mate with in service. In Fig. 3, one of these half-nuts may be seen at *A*. The thread that it engages is on arm *B*.

Clamping of the nut on the half-worm is accomplished by manipulating handle *C* to swing cam *D* upward. This action raises the front end of lever *E* and causes the opposite end to clamp the nut firmly. Handle *F* is then pushed forward to swing the work between the abrasive members. When this has been done, a foot-treadle is depressed to feed the abrasive members against the work. As this operation is performed with water, rubber sheets are mounted on the work-feeding device to protect the operator from splash. Ring-wheels 16 inches in diameter and 3 inches thick are used. The production on each operation is from three to four pieces per minute.

Fig. 4 shows a semi-automatic single-disk machine arranged for finishing one face of small iron castings. As in the previous examples, this machine can be readily adapted for other work by simply changing the work-holding fixtures. The fixtures are of a quick-acting design, and are adjustable to accommodate different sizes of parts.

Fig. 4. Semi-automatic Equipment which Grinds Small Castings at the Rate of 720 per Hour



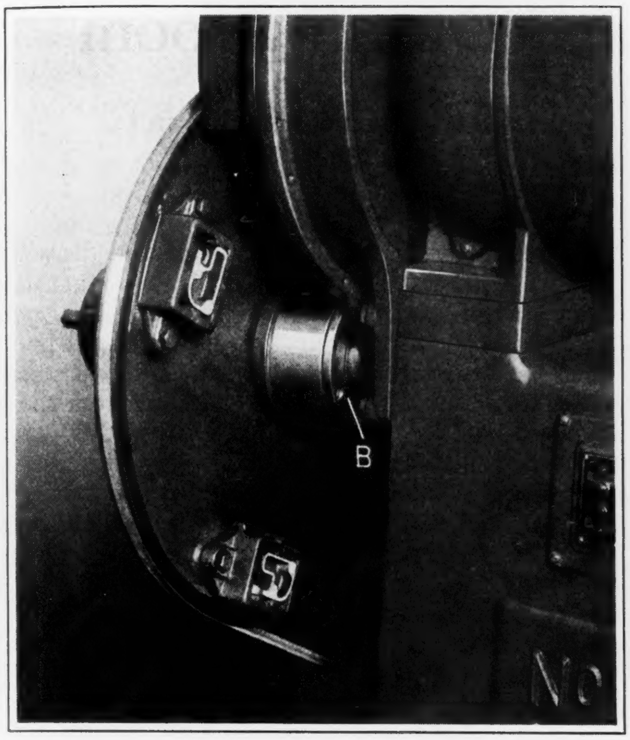


Fig. 6. This Work-carrier Moves Automatically toward the Abrasive Member for Grinding Each Piece

Eight fixtures are mounted around an octagonal drum that revolves continuously. As each fixture reaches a position in front of the abrasive member, the grinding head is automatically advanced toward the work. An automatic action also withdraws the grinding member when the operation is completed. The drum can be stopped at any point by depressing a foot-treadle, which also governs the reciprocation of the grinding head.

For loading any of the fixtures, the operator merely pushes down the back end of clamp *A*, Fig. 5, and loads the piece as shown at *B*. He then releases his hold on the clamp, which springs back into place and holds the work securely. The bottom of the casting is seated on the raised ledges of a hardened and ground block and the casting is located sidewise, as well as from front to back, by blocks *C* and *D*.

An area of from 2 1/2 to 4 square inches is ground on the different sizes of castings, and about 1/32 inch of stock is removed. The average output amounts to twelve pieces per minute, or 720 per hour. An abrasive disk 20 inches in diameter and 3/8 inch thick is used in this operation. The work-carrier is driven by an individual motor.

Rotary Work-carrier of Unusual Design

Figs. 6 and 7 show a machine equipped with a rotary carrier having a micrometer adjustment for moving the entire unit along its supporting bar to compensate for wear of the abrasive member. The small iron castings ground with this equipment are held by spring pressure in small fixtures, such as seen in Fig. 6. In loading each fixture, the operator pushes down a lever projecting from the front of the fixture, as illustrated at *A*, Fig. 7. After the casting has been positioned, he releases the lever, which clamps the casting firmly in place.

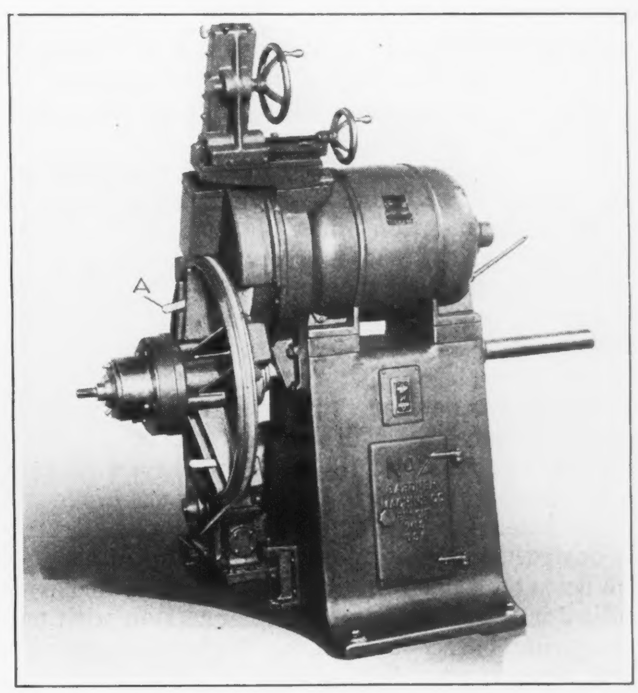
The carrier revolves continuously. As each fixture approaches the top point of the carrier rotation, the entire unit is moved toward the abrasive member. This carrier movement is produced by a cam attached to the inside of the stationary plate *B*, Fig. 6. Spring pressure holds the unit in contact with the cam.

Fixtures can be attached to the carrier to suit parts of different sizes. The unit is driven by a small motor at the rear of the machine. As the object of this operation is merely to clean up the castings, an average production of twenty-five pieces per minute is obtained. An abrasive disk 18 inches in diameter by 3/8 inch thick is used.

S. A. E. STANDARDS FOR SCREW STOCK

At the annual meeting of the Society of Automotive Engineers, a report was adopted revising the screw stock specification No. 1112 in order to improve the machining qualities of this steel. The specifications, as adopted, are as follows: Carbon, 0.08 to 0.16 per cent; manganese, 0.60 to 0.90 per cent; phosphorous, 0.09 to 0.13 per cent; and sulphur, 0.10 to 0.18 per cent. The change is in the manganese and sulphur content. The old specification read: Manganese, 0.60 to 0.80 per cent; sulphur, 0.075 to 0.15 per cent.

Fig. 7. Machine with a Work-carrier that is Adjustable to Compensate for Wear of the Abrasive Disk



Ideas for the Shop and Drafting-room

Time- and Labor-saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

CONSTANT FOR FINDING DISTANCE ACROSS DOUBLE HEXAGON

In designing wrenches and broaches, it is sometimes necessary to find the distance *B* across the inside points of a double hexagon, as shown in the accompanying illustration. By simply multiplying the distance across the flats *A* by the constant 1.03528, the required distance *B* is found without going through the usual involved trigonometrical process. This constant, which was derived by the writer, has saved hours of figuring on certain kinds of work, and is given here with the hope that it may prove of value to other readers of MACHINERY.

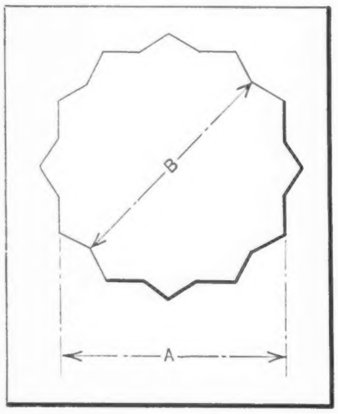


Diagram Indicating Distance B Found by Use of Constant

New London, Conn. CARL H. BRIGGS

DIMENSIONING DRAWINGS FOR JIG BORING MACHINE WORK

In making drawings for certain kinds of work, it is good practice to carry all dimension lines to common base lines at right angles to each other. This applies particularly to tools, jigs, fixtures, templets, and similar work in which a number of holes are to be bored on a jig boring machine, or, in the case of large work, on a horizontal boring machine or miller.

It is the usual practice to run all center lines outside the part itself, and then place all vertical and horizontal dimension lines underneath or to the right of the part. In most cases, this is a satisfactory practice, but there are times when the large number of holes and the closeness with which they are spaced make the drawing too complicated. The method of dimensioning drawings described in the following was developed in order to simplify drawings of this type of work.

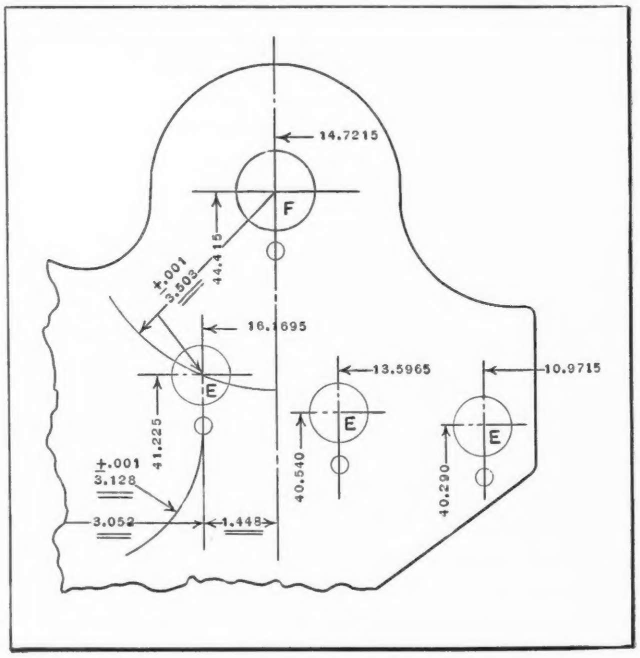
In the accompanying illustration, is shown a very small section of a large plate-type jig used to locate all the holes in a portion of a printing press frame. In designing this jig, plans were made to bore all the holes on a horizontal boring mill provided with indicators designed for use in connection with end measuring bars for checking horizontal and vertical dimensions.

Reference to the small section of the drawing reproduced in the illustration will show that the dimensions of every hole from the base line, and also from a perpendicular line at the right-hand side of the drawing, are placed as near to each hole as possible. There are no lines running from these dimensions to the base lines, except in a few cases where the holes are quite close to these lines. All the more important dimensions are underscored. Those dimensions that are not underscored are used to facilitate the rapid setting of the work where limits of plus or minus 0.005 inch are sufficiently close to meet requirements.

While the positions of all the holes are determined by the dimensions from the base lines, it will be noted that in some instances dimensions are also given between the centers of two holes or by radial dimensions. In most cases, these dimensions indicate the positions of gear centers where the distance from the center of one shaft to another must be held within close limits and is of much greater importance than the horizontal measurements. In such cases, the base line dimensions are used only for setting-up purposes, the final checking being done on the center-to-center dimensions.

The method of dimensioning described makes the drawing comparatively simple and easy to read, as all dimensions are given close to the hole to which they apply. The sizes of the holes are designated by letters, the corresponding sizes being given in a table at one side of the drawing.

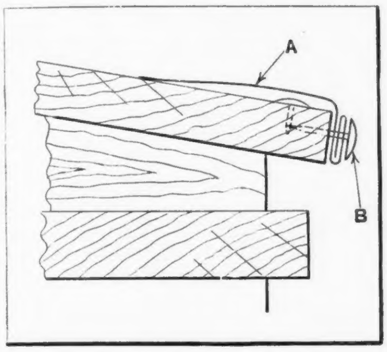
Long Island City, N. Y. DONALD A. BAKER



Simplified Method of Dimensioning Drawings

PROTECTING EDGES OF DRAWINGS ON DRAFTING-BOARD

Anything that helps the draftsman produce neat drawings, such as preventing the lower edge of a drawing from rolling, as described on page 44 of September MACHINERY, is desirable. The writer believes, however, that tracing cloth is superior to cardboard as a means of protecting the drawing, when used as shown in the illustration. The strip of tracing cloth *A* should run the full width of the board and should be about 6 inches wide. This strip is folded lengthwise at points about 1 and 2 inches from the edge. The treble thickness is then secured by thumb-tacks *B* to the front edge of the board, with the folded edge outward and the dull side uppermost. This method of fastening prevents the thumb-tack heads from cutting the cloth, while the natural curl of the cloth keeps its top edge close to the drawing on the board.



Using Strip of Tracing Cloth to Protect Edge of Drawing

The strip of tracing cloth can be folded back when replacing the drawing, without removing the thumb-tacks. The tracing cloth does not interfere with the straightedge, and being transparent, permits a view of the entire surface of the drawing. Also, it can be easily folded back to permit drawing close to the lower edge.

W. S. B.

HOLES IN BELTS DO NOT INCREASE THE PULLING CAPACITY

Every now and then one hears it said that a series of holes punched through a belt will increase its pulling capacity. The claim is also made that holes cut half way through the belt will serve as vacuum cups and will increase the driving capacity. Neither of these claims is true. Holes through a belt simply make it weaker and reduce its driving capacity. Obviously, the contact area is reduced, because where there are holes there certainly can be no belt contact, and the pulling capacity is proportional to the area of the belt contact.

It is also claimed that holes serve as "air escapes," a claim that has never been proved. On the other hand, it has been proved that a plain solid belt having no holes can outpull a belt provided with holes. Thus, the idea of punching holes through a belt can be dismissed as incorrect. Some experimenters who have enthusiastically advocated the provision of holes have also advocated drilling holes through the pulley rims instead of through the belts. This method, at least, does not reduce the strength of the belt, but it has been proved incorrect both in theory and practice.

Newark, N. J. W. F. SCHAPHORST

WARNING BELL INDICATES STOPPING OF REMOTE DRIVE

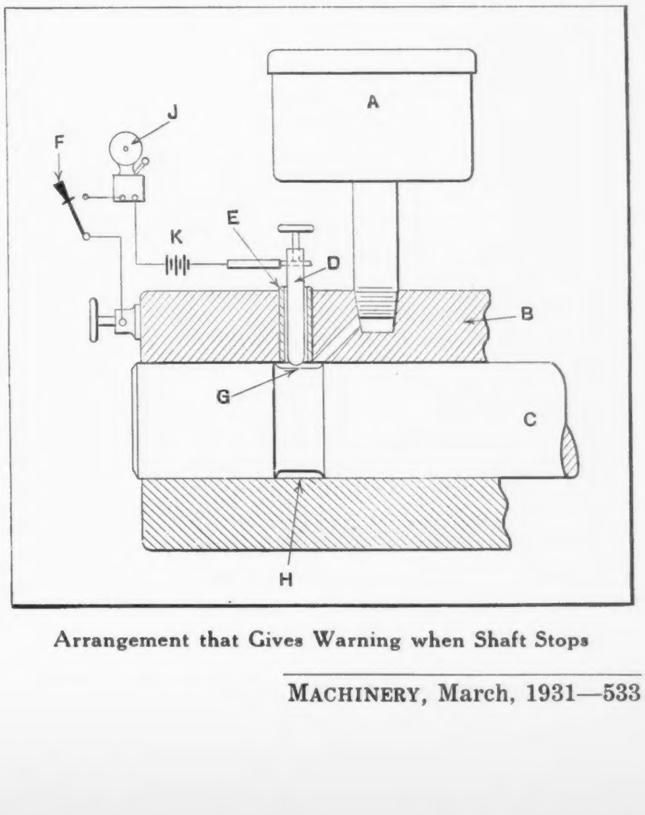
A method of employing an electric bell to sound a warning when a remote drive or shaft stops rotating is shown diagrammatically in the accompanying illustration. This arrangement has been in successful operation for some time. The bell sounds a warning when the shaft *C* stops rotating and also when the bearing *B* fails to receive the proper amount of lubricating oil.

The plunger *D* rides on a film of very light oil at *G* when the shaft is rotating, even at very low speeds. The oil film prevents the metallic contact necessary to complete the electric circuit which rings the bell *J*. This oil film remains unbroken as long as the shaft is in motion and is supplied with the proper amount of lubricating oil. As soon as shaft *C* stops rotating, however, through any cause, such as the failure of the motor or a belt, plunger *D* will come in contact with shaft *C*. This completes the circuit which causes bell *J* to ring.

A steel plunger *D* as long as 5 inches and only 1/8 inch in diameter has been found to work satisfactorily in installations of this kind when the shaft runs at a speed of 1500 revolutions per minute. In the case of very low speeds, it would be best to make the plunger *D* of aluminum.

The bushing *E* is made of Bakelite, but almost any insulating material except rubber may be employed. A switch *F* is provided for shutting off the bell *J* while repairs are being made. An oil-cup *A* keeps groove *H* in the shaft supplied with lubricating oil. Two dry cells are connected in the circuit at *K* to supply the current required to ring the bell.

New York City JOHN E. MORSE



Arrangement that Gives Warning when Shaft Stops

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

A. B.—A manufacturer bought a machine that the seller warranted to be suitable for the purpose purchased. The sales contract also provided that if the machine was not satisfactory, the seller was to be notified and given an opportunity to make any needed changes. The machine was installed, but did not work properly, and the manufacturer, without notice to the seller, made repairs to the value of $400. Is the manufacturer entitled to charge this expense to the seller?

Answered by Leslie Childs, Attorney at Law, Indianapolis, Ind.

Probably not. The general rule is that, under such a sales contract, the seller is entitled to notice of defects, and an opportunity to have necessary changes or repairs made under his supervision. In other words, in such a case, the buyer does not have the right to incur expense, at least until he has notified the seller and the latter has refused or neglected to act. In the light of this rule, it seems clear that the expense incurred by the manufacturer cannot be passed on to the seller of the machine. (282 S.W. 393)

ORDER OF MAKING DRAWINGS

H. L. M.—After the preliminary lay-out or "design drawing" of a new type of machine has been made, what is the proper procedure in regard to making working drawings and the assembly drawing? Is it essential to make the assembly drawing before the detail drawings or is it advisable to make the detail drawings first?

A.—While there is no fixed order of procedure, because conditions vary more or less, we believe that it is good practice to proceed as follows in producing a new design of machine, as, for example, in designing special machinery, etc.

After preliminary calculations and free-hand sketches have been made to indicate the general design, a "design drawing" or preliminary lay-out is made, and this may, of course, be changed considerably or be remade several times, since it is used in connection with the development work. This drawing often is made full size, and it should always be to a large scale; it might be considered as an accurate but unfinished assembly drawing.

From this design drawing or preliminary layout, drawings of the various details are made. These detail or working drawings, which are to be used in the shop, give all necessary working dimensions and include the permissible tolerances, which are made as large as possible without interfering with the functioning either of the part or of the machine as a whole. The amount of tolerance should be based preferably upon the performance of a similar machine or, in lieu of this, upon the designer's general experience and judgment. In either case, the tolerances are not necessarily fixed, but they should be changed later if the actual operation of the machine shows (1) that closer tolerances are essential to proper functioning, or (2) that more liberal tolerances may be allowed for one or more parts without impairing the operation of the machine, the object being to decrease the manufacturing cost.

The direction of a given tolerance relative to the basic or ideal dimension may be divided or it may be all in one direction. The direction in which the tolerance is allowed should be that which is least dangerous, but if a variation in either direction is equally dangerous, then the tolerance should be bilateral, or divided. In determining the direction, the preliminary lay-out may be used as a guide.

The finished assembly drawing is often made by tracing from the design drawing, but in many cases this is not feasible because the finished assembly is drawn to a smaller scale for convenience in handling and to permit using a standard size drawing. Some designers prefer to use the detail drawings in building up the assembly drawing, since this serves as an extra check on the dimensions of the various parts. However, if the design drawing is complete and if the checking of the details has been done properly, the construction of an assembly drawing from details in order to check the latter, should rarely be the means of detecting errors.

In order to avoid delay, the detail drawings might be sent into the shop before making the assembly drawing, especially if the only important function of the assembly drawing is in connection with the actual assembly of the finished parts. An assembly drawing is required in the erecting department, but ordinarily it is not needed in producing the various units or details.

AMOUNT OF BACKLASH FOR SPUR GEARING

L. P.—Is backlash allowed for in connection with the formulas used for determining spur gear tooth dimensions or in the tables of tooth dimensions found in engineering handbooks?

A.—The formulas and tables referred to do not allow for backlash. In other words, gearing is designed as to tooth thickness and center-to-center distance as though there were no backlash, because the introduction of backlash would be impracticable, since the amount varies more or less, as do also the

methods of obtaining backlash. According to the recommended practice of the American Gear Manufacturers' Association, the backlash for industrial spur gearing may be determined by the use of the following formulas:

Minimum backlash = 0.03 ÷ diametral pitch; average backlash = 0.04 ÷ diametral pitch; and maximum backlash = 0.05 ÷ diametral pitch. The result in each case represents the backlash as measured by a feeler inserted between the teeth along the line of action, with the gears at the standard center distance. The gear teeth should be cut thinner than standard by an amount equal to one-half the backlash determined by the formulas given.

Backlash may be obtained in some cases by adjusting the center distance. If the bearings must be located at fixed center distances, the required backlash may be obtained by making the teeth slightly thinner on the pitch circle than one-half the circular pitch. One way to do this is to sink the cutter to a greater depth. If the increase in under-cutting resulting from this practice is objectionable, the only other method is to use a cutter having teeth slightly wider than standard.

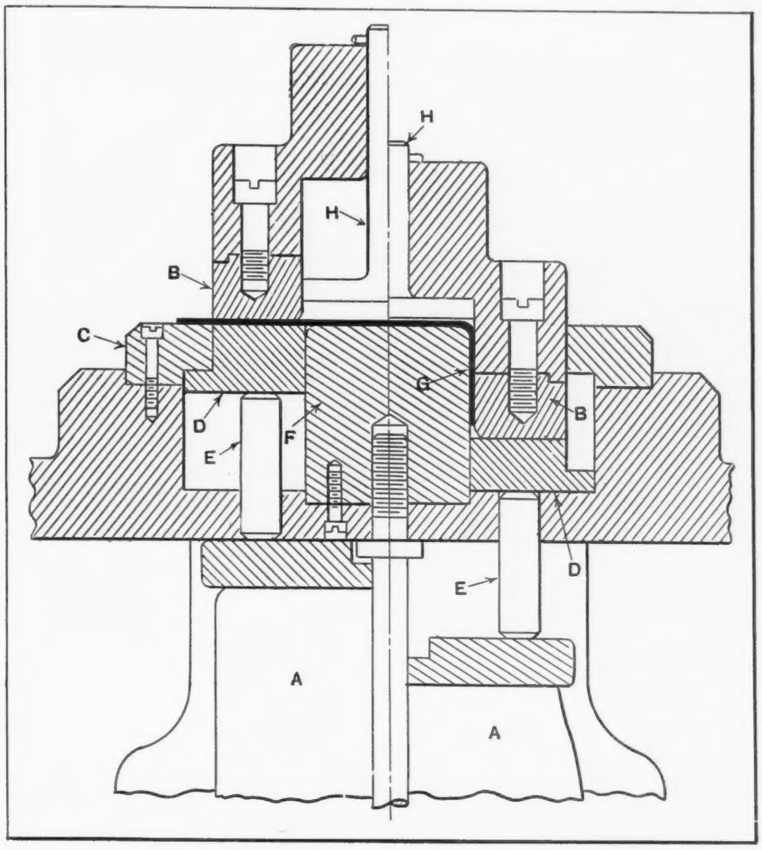
In hobbing gears, the increase in the depth of cut for a given amount of backlash may be obtained as follows: Divide the amount of backlash required by 4 and multiply the quotient by the cotangent of the pressure angle.

DIE FOR DRAWING DEEP SHELLS

J. S. D.—Will someone who has had experience with drawing dies for producing shells about 2 1/4 inches in diameter by 2 inches deep, show the design of a die that has given satisfactory results on this class of work?

Answered by Charles H. Willey, Superintendent of Manufacture, Hoyt Electrical Instrument Works, Penacook, N. H.

The illustration shows the design of a die that we use for drawing meter cases 2 1/2 inches in diameter by 2 1/8 inches deep from stock 1/32 inch thick. The stock is "deep-drawing" brass in rolls 5 1/8 inches wide. This die blanks the disk and draws it to shape in one operation, and while we do not employ any pins above the die to equalize the buffer pressure, as is done in the case of the die described in January MACHINERY, page 368, or any special drawing cushion other than the regular rubber buffer *A*, we have experienced no trouble with fractures.



Die for Blanking and Drawing Deep Shell

Our success in this respect is due, no doubt, to the generous drawing radius of the draw ring *B*, the use of a drawing lubricant, and the fact that the material is "deep-drawing" brass stock. The section at the left of the center line shows the die members in the positions they occupy just previous to blanking, while the members to the right of the center line are shown in the positions occupied at the end of the downward stroke which completes the drawing of the shell.

When the press ram descends, the disk is blanked by the cutting edges of the combination blanking and drawing ring *B* and the blanking die *C*. The blank is held between the face of the ring *B* and the stripper plate or drawing plate *D* which is supported by the pressure pins *E*. As the downward movement continues, the center plug forces the shell up into the drawing ring, the stock sliding under the face of ring *B* and on the top of the plate *D*, which is under the tension or pressure exerted by the rubber buffer *A*. The shell is thus formed or drawn, as shown at *G*. On the up stroke, the shell is knocked out by the pin *H* which is actuated by a stripper bar in the upper section of the power press. Many thousands of shells for meter cases have been made on a die of this kind. The die produces excellent work, and at the rate of 1000 cases per hour.

* * *

In 1929, the United States exported $30,000,000 worth of machine tools and accessories and imported $1,500,000 worth of this kind of equipment.

Grinding Pipe Joints to Obtain an Air-tight Metal-to-metal Seal

Method of Equipping a Cylinder Grinder for Grinding Spherical and Angular Pipe Joints

By V. L. HOWE, Heald Machine Co.

PREVIOUS to the installation of the specially equipped cylinder grinder shown in Figs. 2 and 3, it was the practice to machine and lap the joints of seamless steel pipes used for conveying nitrogen liquid or gas. Three different types of joints were used for this piping, as shown at *A*, *B*, and *C*, Fig. 1. The machining and lapping of the spherical and angular surfaces of these joints entailed considerable expense, as the process often had to be repeated a number of times in order to secure a joint that would have a perfect seal under the testing pressures. The work was made more difficult by the fact that some of the pipes were S-shaped and some were U-shaped; in addition, there were straight sections as long as 30 feet.

The types of joints shown at *A* and *B*, Fig. 1, are made in six sizes ranging from 2 to 12 inches, while the threaded type shown at *C* is made in five sizes ranging from 2 to 6 inches in diameter.

To accomplish this unusual job, the No. 50 Heald cylinder grinder illustrated in Figs. 2 and 3 was equipped for grinding the spherical and angular seats by a thrust cut with a formed grinding wheel having a planetary movement and a fixed amount of eccentricity.

The variety of joints made it necessary for the machine to accommodate four different kinds of pipe ends, and in addition, owing to the range of diameters, to grind eight concave radii and four convex radii for the spherical seats, as well as one 20-degree concave angular seat on the threaded pipe joint. The special equipment provided for this work includes a ball-bearing spindle, spindle extensions, cup-wheels with backing flanges, a four-way reverse valve mechanism, a cam-facing attachment, a special cam-type diamond truing device, and a fixture for holding the different sizes of pipe. It is necessary that the ends of the rough-forged pipe be ground clean without previous machining. The ground joints are required to have a metal-to-metal seal that will withstand a water pressure of 675 pounds and an air pressure of 300 pounds per square inch without evidence of leakage.

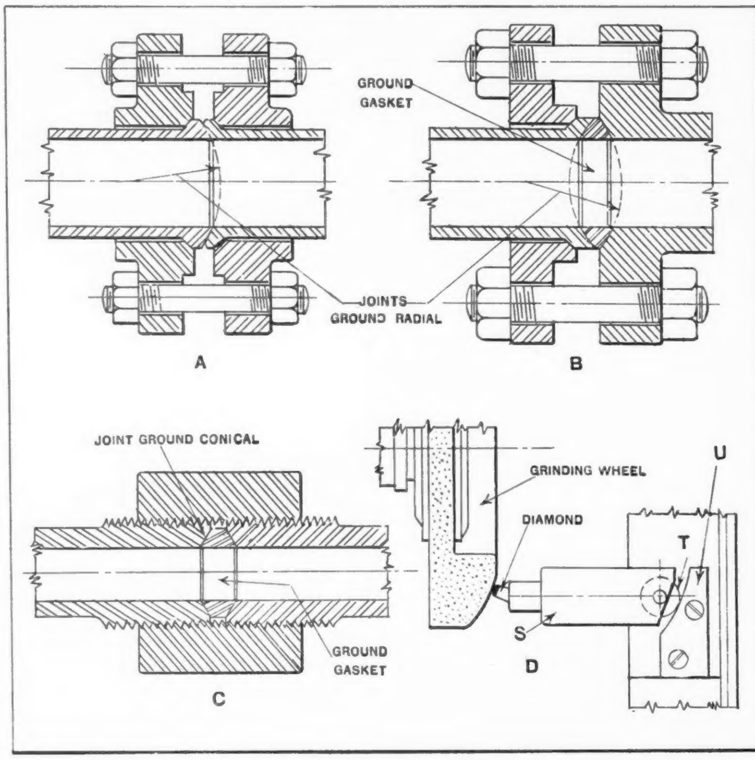


Fig. 1. Types of Pipe Joints Ground on Machine Illustrated in Fig. 2, and Wheel-truing Device

The fixture for holding the pipe is of the two-piece type, the top part *A*, Fig. 2, being hinged to facilitate loading. Adjustable jaws, two in the bottom half and one in the top portion, provide three-point location for the work and accommodate all sizes of pipe. The front jaws of the fixture are graduated with respect to the center line of the grinding spindle to facilitate centering each size of pipe. Supporting screws *B* at the back of the fixture block are adjusted for each different lot of pipe as it comes to the machine. The extreme outer ends are supported by a crane sling or floor stand.

As the planetary type spindle of the grinding machine has a fixed amount of eccentricity, the different sizes of pipe are cared for by using formed grinding wheels of various diameters. The wheel used for each size of pipe grinds on what is termed a "line contact," owing to the fixed eccentric or planetary movement of the grinding wheel spindle and the specially formed contour that is a feature of the wheel itself.

The heavy-duty ball-bearing spindle with fixed eccentric is designed to withstand the strains imposed by thrust grinding. A four-way reverse valve is provided to afford a hand-operated table control, which is less expensive than the usual automatic reverse box. The cam-facing attachment provides a means of governing the rate of feed of the work to the wheel by hand, and also serves as a positive stop.

The cam-type radius-truing device shown in position in Fig. 3 is supported by brackets fastened to the side of the bridge portion of the machine base. The principle on which this truing device operates is shown diagrammatically at *D*, Fig. 1. This device is hinged on the shaft at the back of the machine, so that it can be swung out of the way when grinding, as shown in Fig. 2. A counterweight is provided so that the truing fixture can be easily raised or lowered into position by the operator. When the wheel is to be dressed, the truing device is pulled down and clamped on a bracket supported by the front shaft, as shown in Fig. 3.

The truing diamond is supported in a dovetailed slide *S*, Fig. 1. To this slide is fastened a ball bearing *T*, which acts as a roll on a cam *U* that has the same radius or form as the work to be ground. These cams are made concave, convex, and angular for dressing the grinding wheels to the forms required for the various types of joints. The roll is held securely against the cam by means of two heavy coil springs. A separate cam is, of course, required for each radius ground. The cams are made of hardened steel, and give satisfactory service for a long period of time before replacement becomes necessary.

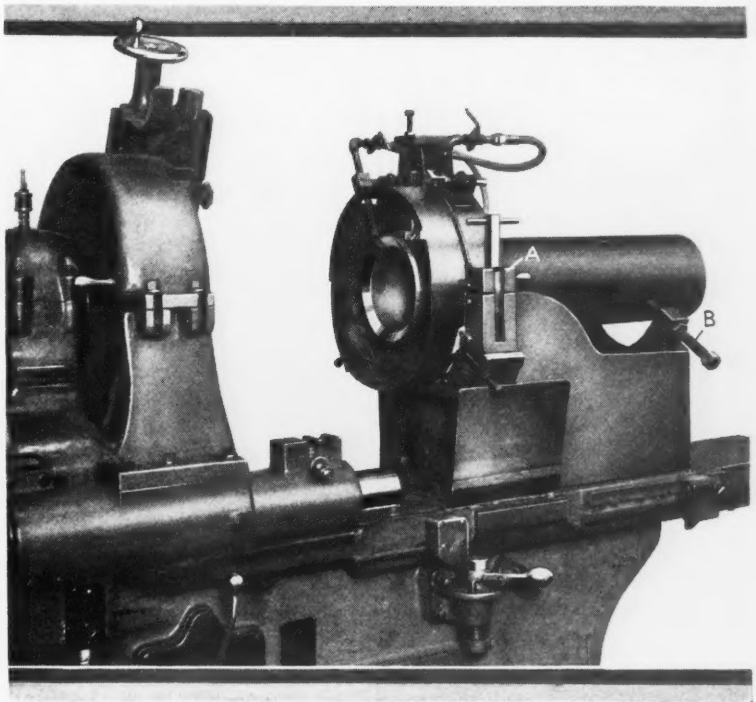


Fig. 2. A Standard Cylinder Grinder Equipped for Grinding Spherical and Angular Pipe Joints

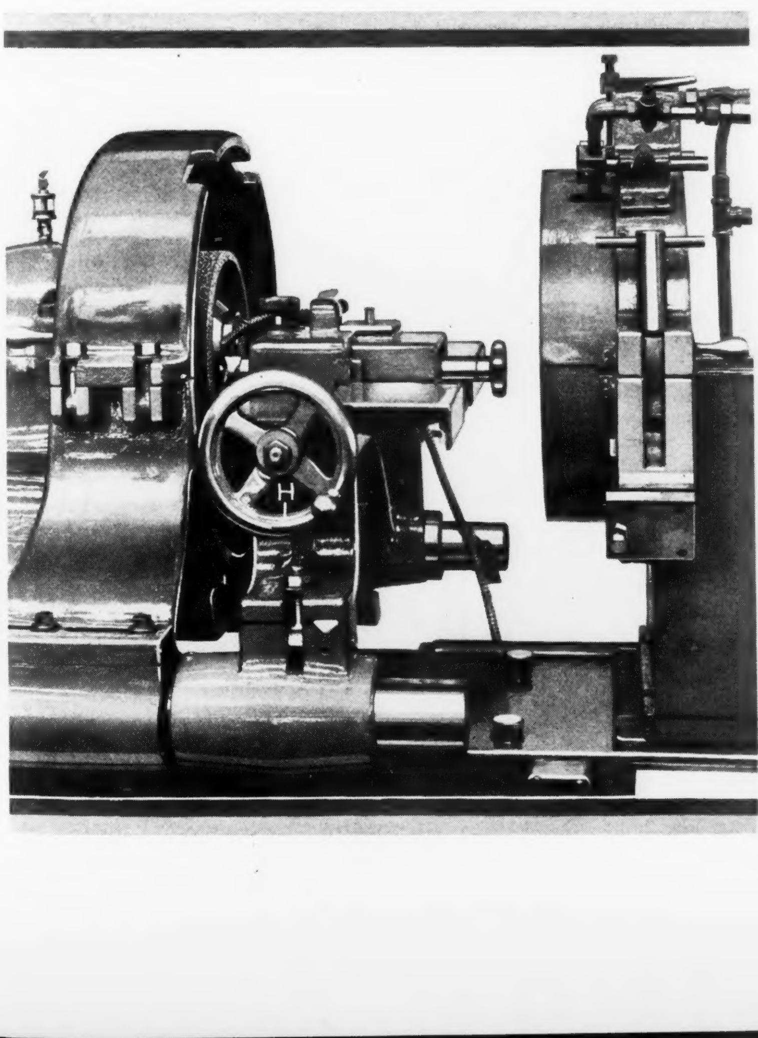


Fig. 3. Cylinder Grinder Illustrated in Fig. 2, Showing the Wheel-truing Fixture in Place

In order to dress the grinding wheel so that it will grind work to the desired radius, the center line of the cam must be on the center line of the work. This adjustment is provided for by having the cam mounted on a bracket that can be swiveled by means of square-head adjusting screws. A gage pin is supplied with each cam to facilitate lining up the center of the cam with the center of the work. After the required adjustment has been made, the cam and bracket are clamped in place. This adjustment proves advantageous whenever the cam is found to have been worn slightly on one side or the other. To compensate for such wear, it is only necessary to readjust the bracket. The truing diamond is passed back and forth across the face of the grinding wheel by means of the handwheel *H*, Fig. 3.

The entire arrangement illustrates the broad field of modern grinding.

Simple Method for Designing Belt Drives

Examples Illustrating the Application of MACHINERY'S Data Sheets on Belting to the Solution of Power Transmission Problems

THE power transmitting capacity of a belt depends primarily on its tensile strength, surface friction properties, and flexibility. Every condition or element that can possibly affect these factors is taken into consideration by power transmission engineers in designing belt drives. To facilitate this work, the Dodge Mfg. Corporation, Mishawaka, Ind., has prepared a set of tables and data sheets. The accompanying table is a condensed form of a table prepared for use in determining the effect of centrifugal force. Other tables for solving belting problems will be found in the Data Sheets in February and in this number of MACHINERY.

Effect of Centrifugal Force on the Power Transmitting Capacity of Belts

The centrifugal force is measured in pounds tension, and increases as the weight and the speed of the belt increase. It increases the tension on the belt and loosens the belt on the pulley. This has the undesirable effect of increasing the strain on the belt and decreasing the effective driving tension.

Assuming that a belt weighs 0.10 pound per piece 1 foot long by 1 inch wide and that the belt speed is 2500 feet per minute, we obtain the centrifugal force per inch of width from the accompanying table in the following manner: In the column at the left side of the table locate the line for a velocity of 2500 feet per minute and follow this line to the right to the column headed 0.10, where we read 5.39 pounds. This is the amount by which the tension on the tight side of the belt is increased per inch of width, due to the centrifugal force, or the tendency of the belt to move away from the center of the pulley as it passes around its periphery, and is, therefore, taken into consideration in calculating the maximum working tension on the belt.

Obviously, this tension must be subtracted from the maximum working tension of a belt in calculating the allowable effective driving tension on the tight side. For example, assume that a belt weighing 0.10 pound per piece 1 foot long and 1 inch wide, and running at a speed of 2500 feet per minute, has a maximum working tension of 130 pounds per inch of width. The centrifugal force 5.39, found in the table, would be subtracted from 130 pounds to obtain the tight side tension per inch of width which is available for actual power transmission. Thus the effective tight side tension equals $130 - 5.39 = 124.61$ pounds per inch of width.

Notation Used in Data Sheets and Formulas

The use of the accompanying table in connection with Data Sheets Nos. 195 and 196 published in February MACHINERY, and Nos. 197 and 198 in March MACHINERY is illustrated by the following examples, in which

D = diameter of large pulley;
d = diameter of small pulley;
d_s = diameter of minimum size pulley, in inches (see Data Sheets Nos. 195 and 196); and
A = arc of contact.

The approximate arc of contact on the smaller pulley when the drive is open and without idlers is found by the formula:

$$A = 180 - \frac{(D - d) \times 4.75}{l} \text{ in which}$$

l = center-to-center distance between pulleys, in feet.

In the following formulas:

T = tension on tight side of belt per inch of width;

Table for Use in Determining the Effect of Centrifugal Force on Belt Tension

Velocity, Feet per Minute	Weights of Belting One Inch Wide and One Foot Long											
	0.05	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.25
	Centrifugal Force T_c in Pounds at Different Velocities for Various Unit Weights											
100	....	....	....	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
500	0.11	0.13	0.17	0.22	0.26	0.30	0.35	0.39	0.43	0.48	0.52	0.54
1000	0.43	0.52	0.69	0.86	1.03	1.20	1.38	1.55	1.72	1.90	2.07	2.15
1500	0.97	1.16	1.55	1.94	2.33	2.72	3.10	3.49	3.88	4.27	4.66	4.85
2000	1.72	2.07	2.76	3.45	4.14	4.83	5.52	6.21	6.91	7.60	8.29	8.63
2500	2.69	3.23	4.31	5.39	6.47	7.55	8.63	9.71	10.80	11.80	12.90	13.50
3000	3.88	4.66	6.21	7.77	9.32	10.80	12.40	13.90	15.50	17.10	18.60	19.40
3500	5.29	6.34	8.46	10.50	12.70	14.80	16.90	19.00	21.10	23.20	25.30	26.40
4000	6.91	8.29	11.00	13.80	16.50	19.30	22.10	24.80	27.60	30.40	33.10	34.50
4500	8.74	10.40	13.90	17.40	20.90	24.40	27.90	31.40	34.90	38.40	41.90	43.70
5000	10.80	12.90	17.20	21.50	25.90	30.20	34.50	38.80	43.10	47.50	51.80	53.90
5500	13.00	15.60	20.90	26.10	31.30	36.50	41.80	47.00	52.20	57.40	62.70	65.30
6000	15.50	18.60	24.80	31.00	37.30	43.50	49.70	55.90	62.10	68.40	74.60	77.70

t = tension on loose side of belt per inch of width;
$T \div t$ = ratio between tensions on tight and loose sides of belt;
$T - t$ = effective tension;
T_m = maximum allowable tight side tension, in pounds per inch of belt width;
T_c = tension exerted on belt due to the effect of centrifugal force;
f = coefficient of friction between belt and pulley;
C = constant by which $(T - t)$ is multiplied to obtain the tension on the tight side (see Data Sheet No. 198);
h = thickness of belt, in inches;
W = weight of belting, in pounds per piece 1 inch wide by 1 foot long;
R.P.M. = revolutions per minute;
V = belt speed, in feet per minute = diameter of pulley $\times \dfrac{3.1416 \times \text{R.P.M.}}{12}$;
H.P. = horsepower transmitted by belt = $\dfrac{V \times (T - t)}{33{,}000}$; and

$$T - t = \frac{\text{H.P.} \times 33{,}000}{V}$$

Example—A lineshaft is to be driven at a speed of 250 revolutions per minute by a 15-horsepower motor having a speed of 1150 revolutions per minute. The motor is equipped with an iron pulley having a diameter of 8 inches and a face width of 6 inches. The center-to-center distance between shafts is 12 feet, and the maximum load at starting is 20 horsepower. What size or weight of oak-tanned leather belt should be used? The diameter D of the larger or driven pulley $= \dfrac{1150 \times 8}{250} = 36$ inches.

$$A = 180 - \frac{28 \times 4.75}{12} = 169\text{, say, } 170 \text{ degrees}$$

In drives where an idler is employed, the arc of contact may be determined by laying out the drive to scale and measuring the arc of contact with a protractor.

$$V = \frac{8 \times 3.1416 \times 1150}{12} = 2400 \text{ feet per minute}$$

As the maximum load at starting is 20 horsepower, a 6-inch belt must transmit $20 \div 6 = 3.33$ horsepower per inch of width. Now

$$T - t = \frac{3.33 \times 33{,}000}{2400} = 46 \text{ pounds,}$$

approximately

Referring to Data Sheet No. 197, we find the coefficient of friction of an oak-tanned leather belt on an iron pulley to be 0.25. Now referring to Data Sheet No. 198, we find on the line for an arc of contact of 170 degrees and in the column for a coefficient f of 0.25, the constant $C = 1.90$. Thus we have,

$$T = 1.90 \times 46 = 87 \text{ pounds}$$

Assuming a weight of 0.10 pound for the belt per piece 1 inch wide by 1 foot long, we find in the accompanying table, opposite 2500 feet per minute and under 0.10 pound, the centrifugal force $T_c = 5.39$ pounds. This added to 87 pounds $= 87 + 5.39 = 92.39$, or, say, 92 pounds. This is the total tight side tension to which the belt would be subjected.

Referring to Data Sheet No. 195, we find that a medium single 16-ounce leather oak-tanned belt has a maximum allowable tight side tension of 100 pounds per inch of width. As this size belt has a weight of only 0.083 pound, as compared with our assumed weight of 0.10 pound, it is apparent that it will transmit the required power and still keep well within its allowable working tension.

Example—Find the necessary width of a heavy single cotton-woven belt for the same drive. Referring to Data Sheet No. 195, we find that this belt has a maximum allowable working tension of 130 pounds, that the coefficient of friction is 0.22, and that the weight per piece 1 foot long by 1 inch wide is 0.13 pound.

Referring to the accompanying table, we find that the centrifugal force for a belt weighing 0.14 pound per piece 1 inch wide and 1 foot long is 7.55, say 8 pounds. We therefore have, $T = 130 - 8 = 122$ pounds. Referring to Data Sheet No. 198, we find that for a coefficient of friction of 0.20 and an arc of contact of 170 degrees, the factor $C = 2.23$, and that for a coefficient of friction of 0.25 and an arc of contact of 170 degrees, $C = 1.90$. Interpolating between these values for $f = 0.22$, we have $C = 2.11$. The effective tension $(T - t) = T \div C = 122 \div 2.11 = 57.8$, or, say, 58 pounds.

Now as H.P. $= \dfrac{V \times (T - t)}{33{,}000}$, the power transmitted per inch of width at an effective tension of 58 pounds $= \dfrac{2400 \times 58}{33{,}000} = 4.2$ horsepower.

As the maximum load is 20 horsepower, we have $20 \div 4.2 = 4.7$ inches, or, say, 5 inches as the width of belt required.

* * *

The Detroit local section of the American Society of Mechanical Engineers met February 16 to discuss machine shop equipment problems. Millard Romaine, manager of the engineering service department of the Cincinnati Milling Machine Co., presented a paper on "Recent Milling Machine Applications." Hans Ernst, research engineer of the same company, spoke on "Hydraulic Applications in Machine Tools," and demonstrated an unusual testing device illustrating the shock-absorbing qualities of hydraulic feed mechanisms.

Ramet—a New High-speed Cutting Metal

Remarkable Wear Resistance at High Cutting Speeds is Characteristic of a Newly Developed Cutting Metal in which Tantalum is the Principal Constituent

THE name "Ramet" is derived from the two words "rare metal" because of the fact that the outstanding constituent of this new material is the rare metal tantalum. Ramet is a development of the Fansteel Products Co., Inc., North Chicago, Ill., and like many developments of this kind, has an interesting history.

The chemical element, tantalum, which has made this new material possible, was discovered in 1802. Today the only extensive deposit of tantalum bearing ore is located in the desolate Pilbarra district of western Australia, where it is mined under exceedingly difficult working conditions. The thermometer frequently stands at 126 degrees F. at this mine and the ore is brought 450 miles to the nearest shipping point by camel caravans.

In 1801 the oxide of a new metal was found in a black mineral that was kept in the British Museum. This new metal was named columbium, because its ore, columbite, came from the United States. In the following year, another investigator discovered in columbite ore another metal besides columbium, but while he succeeded in establishing the existence of this new chemical element, he was unsuccessful in separating it from its tightly locked compounds. To this new material he gave the name tantalum. This metal fully justified its name by the tantalizing manner in which it resisted the efforts of the scientists who endeavored to separate it from its compounds.

However, in 1903, a process was developed for producing a ductile form of tantalum capable of being drawn into fine wire for use in the filaments of incandescent lamps, which were produced in large quantities both in Germany and the United States. The tantalum, however, was all produced in Germany.

In 1904, while working for his doctor's degree, Clarence W. Balke began the study of the compounds of tantalum and columbium and succeeded in determining the atomic weights of both metals, facts that had previously been unknown. Joining the staff of the Fansteel Products Co., Inc., Dr. Balke carried on the study of tantalum, with the result that he visualized wider commercial applications of this metal, and in 1922, his work had been carried to the point where almost chemically pure tantalum was obtained by a process that made it possible to produce sheets or bars of the metal of any required size.

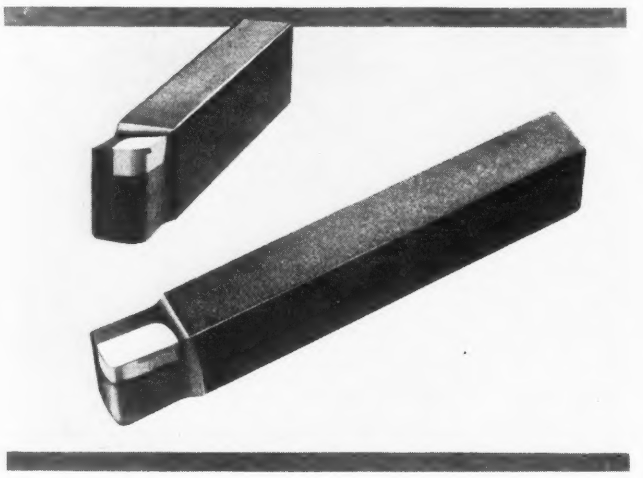


Fig. 1. Ramet Turning and Facing Tools

Principal Processes in Making Ramet

Following the work referred to, Dr. Balke developed Ramet. Stated briefly, Ramet consists of the chemical compound tantalum-carbide which is bonded together with metallic nickel, although other bonding materials may be employed successfully.

The process of manufacture is an interesting one. After producing the carbide of tantalum, this material is pulverized in the familiar type of ball mill, and metallic nickel is added. The material produced in this manner is next taken in the form of a powder and pressed in dies in hydraulic presses, with the result that sufficient cohesion is secured to allow the material to be handled. The pieces formed are then placed in an electric furnace, where they are subjected to a high temperature, which results in sintering the material together, thus producing the metal Ramet.

Tested on a Rockwell machine, using the C scale and a 60-kilogram weight, Ramet shows a hardness of from 88.5 to 90.5. By suitable modifications, this hardness can be varied to cover a range of from 80 to 94, but for commercial purposes it is held to the range first mentioned. Within this range the material combines the best balance of hardness and strength. Tested under transverse loading, the strength is from 250,000 to 300,000 pounds per square inch. The melting point of tantalum-carbide is around 4400 degrees C. (7950 degrees F.) The density is 235 grams per cubic inch. A noteworthy property of this material is its low heat conductivity.

Method of Securing Ramet to the Steel Shank

As Ramet is a fairly high priced material, only a small inset of this metal is used to form the cutting edge of a tool. This is done by machining a

steel shank with a "shelf" on which the Ramet inset is secured by brazing. Various materials can be used for brazing, but the common practice is to use pure metallic copper. Preparatory to brazing, the Ramet inset is prepared by a heat-treatment and a subsequent nickel-plating process. Two of the completed Ramet tools are shown in Fig. 1, while Figs. 2 and 3 show typical applications of these tools.

The tendency of a tool to become heated is caused by the heat from the chip being conducted to the tool and also by the heat generated by friction when the chip passes over the lip of the tool. The low heat-conducting capacity of Ramet is important in that there is less danger of loosening the brazed joint between the inset and the shank of the tool than would be the case with a material of high heat-conducting capacity. It is possible to hold the shank of a 6-inch tool between the bare fingers while the Ramet point removes chips that are actually red hot.

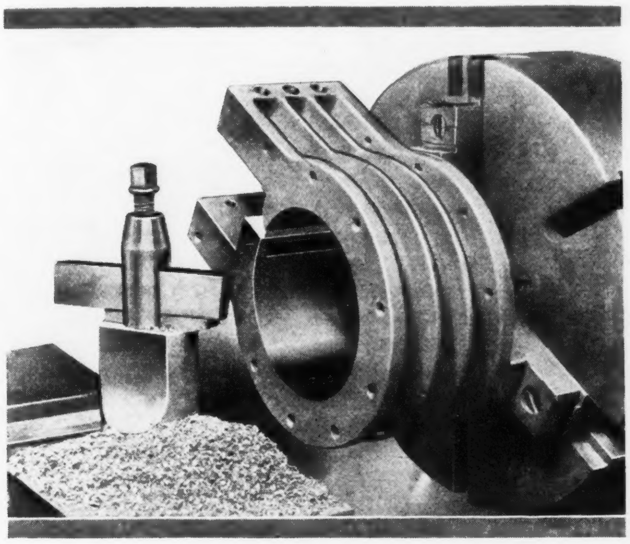


Fig. 2. Semi-steel Casting which Previously Required Two Cuts Now Being Finished with Ramet Tool in One Cut

Extreme Hardness Indicated by Tests

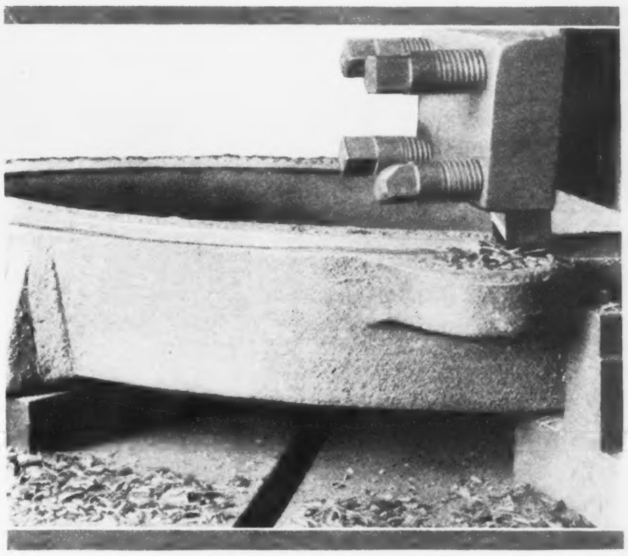
The hardness of Ramet is indicated by the fact that it is able to machine manganese steel which, until recently, was regarded as a material that could only be finished by grinding. Also, certain "trick" jobs can be performed, such as the turning of hardened high-speed steel. In handling such work, there is no tendency for the chip to become welded on the surface of the Ramet inset and form an alloy of sufficient softness to cause rapid abrasion of the tool, as is the case with some cutting metals.

Ramet tools have already found successful applications in seventy-five well-known industrial plants, where they are used for a wide range of work. The tools used in these plants are ground to about standard angles of clearance and rake. Ramet is adapted for all classes of small tools, such as those used for turning, facing, boring, as well as for inserted-tooth milling cutters.

An idea of its working capacity may be obtained from the fact that in turning No. 1050 S.A.E. steel, a sample billet was reduced from 3 to 2 inches in diameter at a single cut. This was done with a feed of 0.020 inch per revolution and a cutting speed of 170 feet per minute. The machine on which this operation was performed is equipped with burnishing follower rolls. The diameter was held to a very close tolerance.

If Ramet bits are used in tool-holders, the clamping means should be applied practically the full length of the tool bit. Ramet is furnished in pieces of the size required for a given line of work, and is ground to the required form. It cannot be remelted. In addition to its application in cutting tools, it is successfully employed for wire-drawing dies.

Fig. 3. Removing 5/8 Inch of Scale and Metal from 33-inch Car-wheel Chill at a Speed of 62 Feet per Minute



The Fansteel Products Co., Inc., manufactures the metal only, and does not make Ramet tools, but licenses tool manufacturers to use this material in their products. Among the companies so licensed are the Illinois Tool Works, Chicago, Ill., and the McCrosky Tool Corporation, Meadville, Pa.

* * *

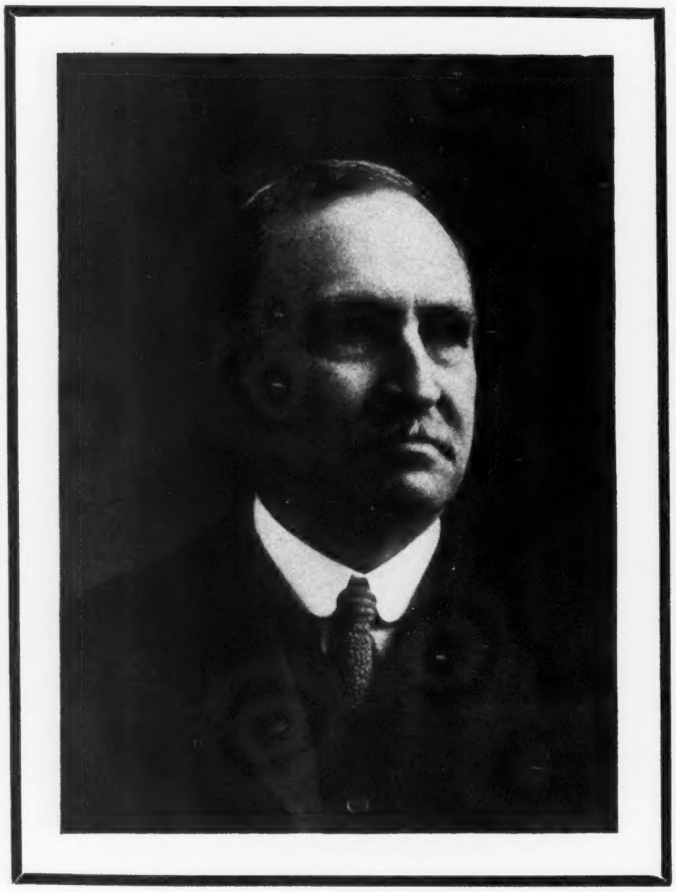
At the end of 1930 there were 26,718,000 passenger cars and trucks registered in the United States. Of these 23,200,000 were passenger cars and 3,518,000 trucks. The total number of motor vehicles registered throughout the world is 35,518,000. Thus 75 per cent of all the automobiles in the world are operated in this country.

Alexander Luchars

As we go to press this month our hearts are bowed in sorrow. Alexander Luchars, founder and publisher of MACHINERY and president of The Industrial Press, died at his home in Upper Montclair, N. J., Thursday, February 19, after an illness of less than two weeks. The tragedy is made deeper by the fact that his wife, Sarah R. Luchars, died within a few hours of his passing, both deaths resulting from pneumonia.

In the death of Mr. Luchars this organization has lost not only its chief and leader, but a man who was a friend in the truest sense of the word to every member of the staff.

Born in Quincy, Mass., February 10, 1854, Mr. Luchars was 77 years old at his death, having rounded out a long life of activity and achievement. He was educated at the Chauncey Hall School, Boston, Mass., and at the Massachusetts Institute of Technology where he took a course in architecture. After having been engaged for some years in an architect's office in Boston and in newspaper work, he turned from these fields to the technical publishing business which proved his life work.



Alexander Luchars, Founder of MACHINERY

In 1889 he established himself in New York where he founded The Industrial Press. He published a number of journals in the engineering field, and in 1894—thirty-seven years ago—he published the first number of MACHINERY, which journal today stands as a monument to his energy, ability, and unswerving adherence to the highest standards. In the early days of the mechanical engineering industry he had the courage and vision to see the need for a greater service, and was one of the pioneers in the establishment of present-day technical journalism. He served the machinery industries not only through MACHINERY, but also through an extensive line of mechanical books on engineering subjects published by his company. He also established the Machinery Publishing Co., Ltd., of London, England, publishers of British MACHINERY, one of the leading engineering journals in Great Britain.

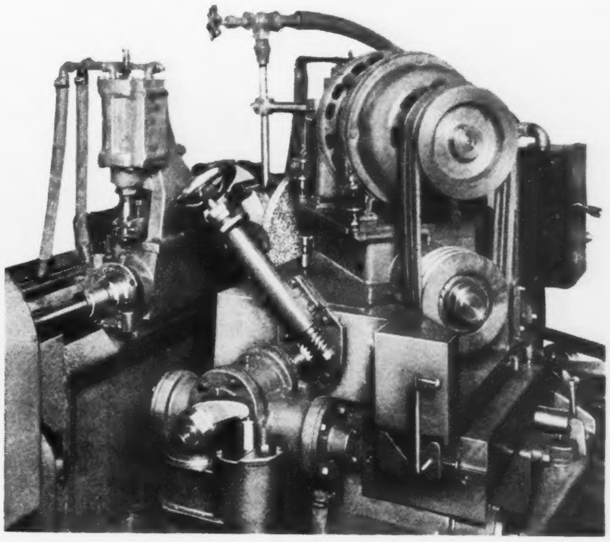
Mr. Luchars took an active part in furthering the interests of the machine tool and shop equipment industries, and leaves scores of warm friends among the machinery manufacturers throughout the country, many of whom he knew from the very beginning of their business career. In 1919 the Secretary of Commerce appointed him special trade commissioner of the Government to study the machinery markets in Europe. Mr. Luchars was an active civic worker in Montclair, N. J., his home town, and after the World War he donated a war memorial tower to the St. James' Protestant Episcopal Church in Upper Montclair, of which church he was a warden for about fifteen years. For a number of years he was one of the governors of the Machinery Club of New York.

Mr. Luchars is survived by his son, Robert B. Luchars, vice-president of The Industrial Press, and by two daughters, Mrs. Leigh Roy Urban of Springfield, Mass., and Mrs. Kenneth D. Ketchum of Cohasset, Mass.

LUCIAN SHARPE

Lucian Sharpe, a vice-president of the Brown & Sharpe Mfg. Co., Providence, R. I., died suddenly at Chablis, France, January 26, at the age of fifty-nine years. Lucian Sharpe was a brother of Henry D. Sharpe, president and treasurer of the Brown & Sharpe Mfg. Co. He was born in Providence in 1871, and was educated at Yale and Brown Universities, graduating from Brown University in 1893 with the degree of A.B. After leaving college, he spent several years in the various departments of the Brown & Sharpe Mfg. Co., which was founded and developed by his father. He was for a time treasurer of the company, and later, a vice-president. Several years ago, he took up his residence abroad. He traveled extensively throughout Europe, being deeply interested in art. In 1914, King Alphonso conferred upon him the title of Grand Knight of the Order of Charles III, the most ancient of Spanish orders.

New Shop Equipment



Latest Developments in Metal-working Machines, Small Tools, and Work-handling Appliances

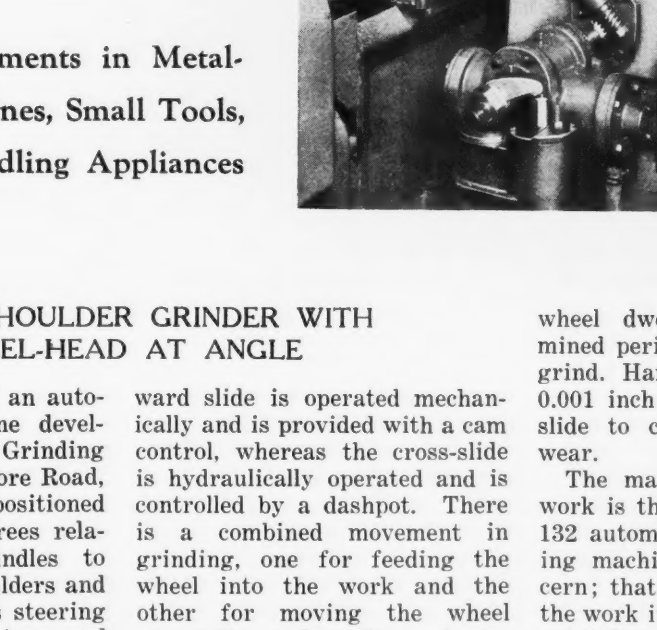
ARTER SHOULDER GRINDER WITH WHEEL-HEAD AT ANGLE

The wheel-spindle of an automatic grinding machine developed by the Arter Grinding Machine Co., 15 Sagamore Road, Worcester, Mass., is positioned at an angle of 45 degrees relative to the work-spindles to facilitate grinding shoulders and fillets on such parts as steering sectors, differential pinions, and other work that can be held on centering devices. The construction can be clearly seen in the heading illustration. The grinding is done with the periphery of the wheel, which is dressed so that the cutting face is parallel with the shoulder on the work. The wheel-spindle is mounted in ball bearings of the preloaded type. It is driven through three V-belts by a constant-speed motor mounted directly on the wheel-head.

The wheel-head unit has two slides, one of which moves toward the work, and the other parallel with the work-spindles. The forward slide is operated mechanically and is provided with a cam control, whereas the cross-slide is hydraulically operated and is controlled by a dashpot. There is a combined movement in grinding, one for feeding the wheel into the work and the other for moving the wheel across the work surface. A positive stop is provided for both movements, so that the grinding wheel dwells for a predetermined period at the end of each grind. Handwheels graduated to 0.001 inch are provided on each slide to compensate for wheel wear.

The manner of handling the work is the same as on the No. 132 automatic cylindrical grinding machine built by this concern; that is, the operator loads the work in a turret and the turret indexes to carry the piece to the grinding position, where two live centers pick it up and drive it. Clearance is provided in the turret hole, and the front of the turret is cut away to allow the wheel to come in contact with the work. After the grinding operation, the centers withdraw and the work is carried by the turret to a station where it is automatically ejected.

The grinding wheel can be dressed without disturbing the work set-up by means of an attachment mounted on the top slide. This attachment has two slides, which may be conveniently adjusted through hand-



Arter Grinding Machine with Wheel-spindle at an Angle of 45 Degrees to the Work-spindles

wheels graduated to 0.001 inch. By observing the readings on the handwheel dials, the amount of wheel reduction can be readily determined and compensated for by adjusting the handwheels of the wheel-head slides.

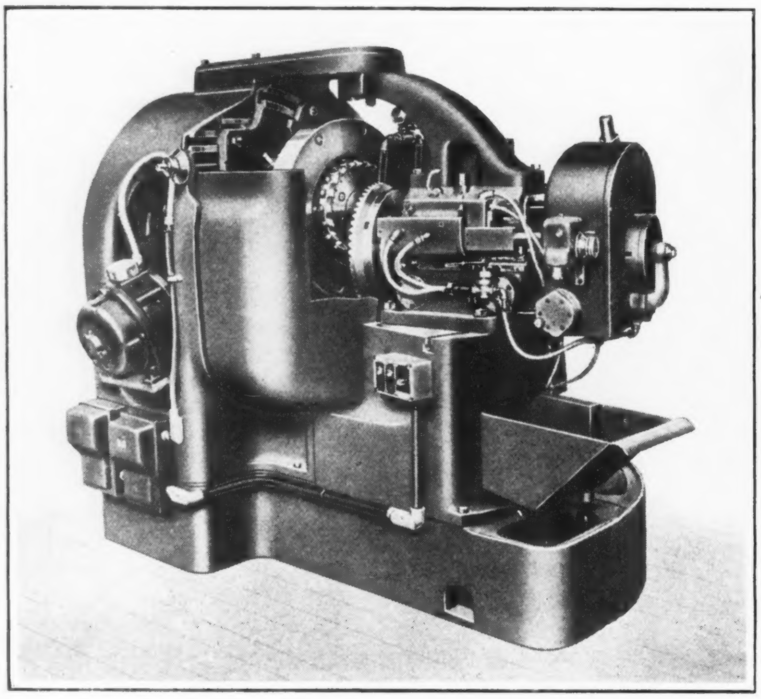
Cams control the synchronous movements of the headstock and tailstock spindles, the two wheel-head slides, the work turret indexing mechanism, and the work ejector. Both cams that control the wheel-slides are split to permit quick removal when a work change presents different grinding conditions. The work turret is also split for the same purpose. The turret is indexed by a Geneva motion.

The longitudinal movements of the headstock and tailstock spindles are obtained by air pressure under cam control, although hand operation of the spindles is also available. These spindles are driven by full-floating pulley units designed to relieve them of all belt pressure or vibration.

GLEASON HYDRAULIC ROUGHER FOR SPIRAL-BEVEL GEARS

An automatic machine in which all the movements are effected hydraulically has been developed by the Gleason Works, 1000 University Ave., Rochester, N. Y. With this design, the time required for roughing the gears has been reduced 60 per cent over the former method. Safety features are embodied in the machine to minimize the danger of breaking the cutter, and the operation has been made as nearly fool-proof as possible. This machine has been designed particularly for use in connection with Gleason spiral-bevel gear generators.

After the gear blank and clamp plate have been put on the spindle by the operator, the work is chucked hydraulically by the opening of a valve. Then the starting button is pushed to move the head into position and start the cutter motor. The tooth slots are cut in the gear by a simple depth-feed motion of the cutter into the work, there being no generating motion. After each slot is cut, the cutter is withdrawn to permit the work to be indexed into position for the next cut.



Gleason Spiral-bevel Gear Rough-cutting Machine which is Hydraulically Operated Throughout

The housing in which the cutter-spindle is mounted is bolted direct to the machine base, and the work-spindle housing is fastened to the frame of the machine. An overhead tie between the two heads adds to the rigidity of the construction. The entire saddle assembly is adjustable both horizontally and vertically to set the cutter to the desired spiral angle. The spindle sleeve in which the cutter-spindle is journaled is hydraulically operated for the feed movement, the depth of feed being controlled by an adjustable stop-screw. A control valve is operated to change the time of cutting each tooth. The cutter is driven through a pinion meshing with an internal gear bolted to the cutter-spindle faceplate. Change-gears enable various cutter speeds to be used.

The work-head has the usual angular and linear adjustments to accommodate gears of various pitch angles and cone distances. The work-spindle remains stationary during the operation, except when the work is indexed. When all the teeth have been roughed out, the work moves away from the cutter automatically to facilitate removal.

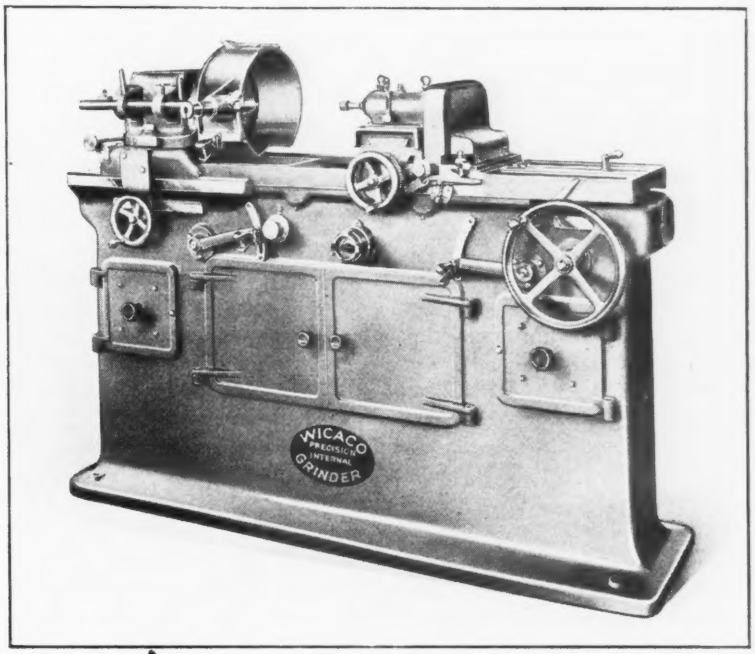
The hydraulic chucking mechanism is an integral part of the machine. The gears are chucked by being drawn back against a shoulder on the arbor by a draw-rod that extends to the back of the work-spindle. This rod is adjustable for length, and the chucking mechanism, with the exception of the arbor, can be used for any gear of standard design. The index mechanism is also actuated hydraulically. To change from one number of teeth to another, it is only necessary to change the index-plate and the setting of the automatic stop. This stop resets itself after each blank has been roughed, eliminating any possibility of recutting a tooth.

Pressure for the hydraulic system is obtained through a unit in the machine which is driven by a three-horsepower motor that also drives a coolant pump. The cutter-spindle is

driven by a five-horsepower constant-speed motor. Lubricant is furnished automatically to the various working parts of the machine. Standard Gleason 9-, 12-, 15-, and 18-inch roughing cutters are employed.

MAEHLER OIL-FIRED OVEN HEATER

In an oil-fired heater designed by the Paul Maehler Co., 2208-20 W. Lake St., Chicago, Ill., for application to industrial ovens, the oven air is kept in circulation and inflammable or explosive vapors are consumed. The heated air from the heating chamber is forced into the oven by a blower at the outlet end of the heater, creating a slight pressure which distributes the heat evenly throughout the oven and provides a uniform temperature at all points. Recirculating air drawn from the oven at a high temperature is reheated and mixed with a controlled volume of fresh outside air. This heater is suitable for various types of industrial ovens using temperatures up to 750 degrees F., such as enamel-baking and core-baking ovens.



Wicaco Internal Grinder which Has a Water-cooled Wheel-head

WICACO PRECISION INTERNAL GRINDING MACHINE

One of the important features of a precision internal grinding machine which has been placed on the market by the Wicaco Machine Corporation, Stenton Ave. and Louden St., Philadelphia, Pa., is a patented water-cooled wheel-head. The oil chamber and bearings of this head are surrounded by a generous cooling jacket through which ordinary grinding coolant is pumped continuously. The advantage claimed for this construction is that the wheel-head can be operated continuously without any appreciable rise in the temperature of the bearings.

The wheel-head is mounted on the upper of two cross-slides. The upper slide provides both automatic and hand cross-feeds, while the lower slide is designed to permit quick settings for grinding tapers or work of two or more diameters. The wheel is fed automatically at each end of the carriage travel or it may be fed straight into the work. The automatic feed can be varied in increments of 0.0002 inch from 0 to 0.001 inch per stroke.

The carriage is driven by a variable-speed motor equipped with a rheostat control that provides sixteen traverse speeds ranging from 20 to 60 inches per minute. A safety device automatically reverses the carriage without damage to the machine in case an obstruction should be placed between the carriage or wheel and a fixed part of the machine. Besides keeping down repair costs, this feature facilitates the grinding of blind holes or shoulders.

The work-head and carriage are both driven by motors mounted directly beneath them on doors in the bed, where they are readily accessible for inspection. The wheel-drive motor is suspended under the center of the carriage, so that the ways rather than the head absorb the torque. All drives are equipped with a constant-tension device. The location of the motors protects them from moisture and grit.

The work-head spindle is mounted in two bearings that can be positively adjusted. The speed of the spindle is controlled through the lever at the left-hand end of the headstock, a rheostat on the variable-speed motor providing sixteen work speeds. The work-head is graduated from 0 to 15 degrees.

Work up to 12 inches in diameter can be swung inside the water guard, and the machine will grind holes up to 10 inches deep. The weight of the machine is approximately 2400 pounds.

GRANT VIBRATORY RIVETING HAMMER

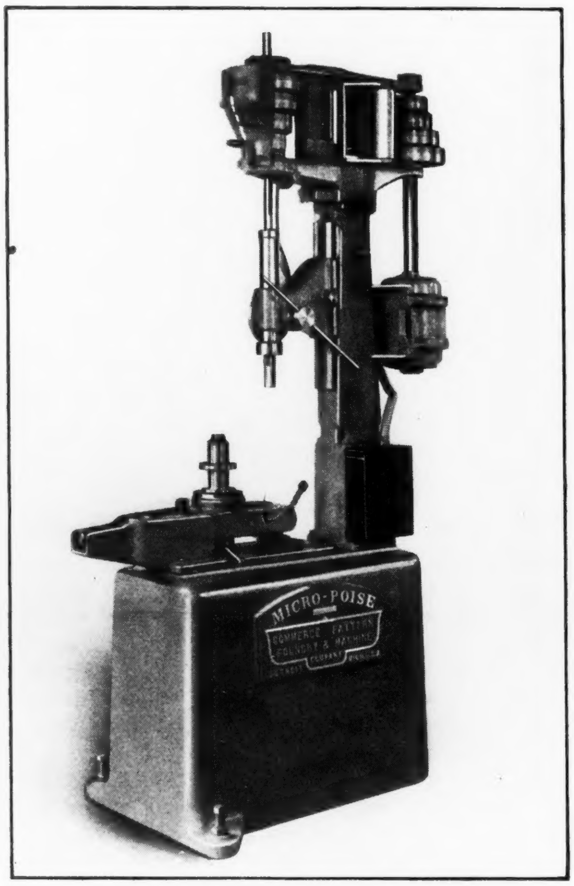
A riveting machine of the design illustrated has been added to the products of the Grant Mfg. & Machine Co., N.W. Station, Bridgeport, Conn., for cold-heading rivets from 3/8 to 1/2 inch in diameter. This type of riveting machine is known as a "vibratory hammer," because the hammer spindle reciprocates vertically between 1500 and 1800 times per minute.

The frame is a single casting, designed to withstand the vibrations, and the table is likewise of heavy construction to provide a rigid support for the work. The table is clamped to the frame by two heavy bolts, and is supported by an adjustable bracket keyed to the frame. Raising and lowering of the table in small amounts is accomplished by turning a screw in this bracket after the table clamping bolts have been loosened. For hammer spindle is rotated clockwise by worm-gearing inside of the spindle arm, the worm-shaft being driven by a V-belt which connects it with the main shaft at the rear of the machine. The hammer spindle is made from chrome-vanadium steel and heat-treated.

The helve is made from hickory, and resembles a large flat spring. It is held in a fulcrum lever which, in turn, is connected to the main drive shaft through a rod mounted on an eccentric. The fulcrum lever transmits the power to the helve.

The main pulley incorporates a clutch of the friction type equipped with Raybestos lining. There is a brake to stop the hammer spindle in its uppermost position so that the work can easily be put in place and removed. The time required for heading a 1/2-inch rivet is two seconds. The machine is driven by a two-horsepower motor.

Grant Riveting Hammer with Spindle that Rotates as it Reciprocates Vertically



Micro-Poise Balancing Machine for Flywheels and Other Parts of Short Axis

greater adjustments, the bracket is moved to the next cross-slot in the front of the frame and the table shifted a corresponding amount. The table has a flat top to receive fixtures, but special tables can also be furnished to suit the work.

The riveting tool or peen is threaded to fit the outside of the hammer spindle, and is made from hexagonal stock to permit the application of a wrench. The

IMPROVED MICRO-POISE BALANCING MACHINE

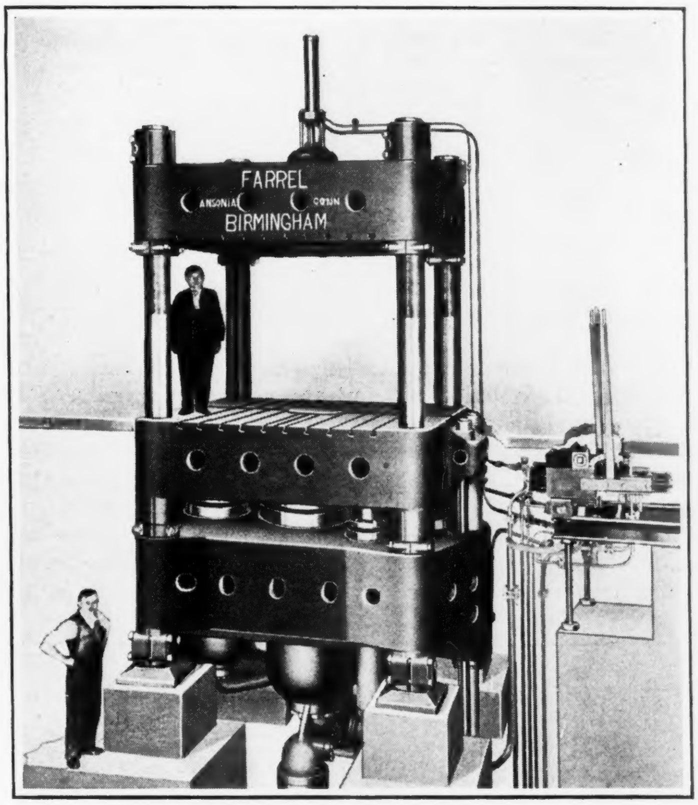
An improved Micro-Poise balancing machine has recently been placed on the market by the Commerce Machine Co., 2211 Grand River Ave., Detroit, Mich., for detecting the amount and location of unbalance in parts and making the necessary correction without removing the work from the machine. The equipment is especially adapted for handling flywheels, pulleys, and other rotating parts of comparatively short axis. This machine is designed to balance parts to within a limit of 1/4 ounce-inch. Production rates in balancing flywheels range from forty to fifty per hour.

By means of a universal spirit level, the machine instantly indicates the angular location of un-

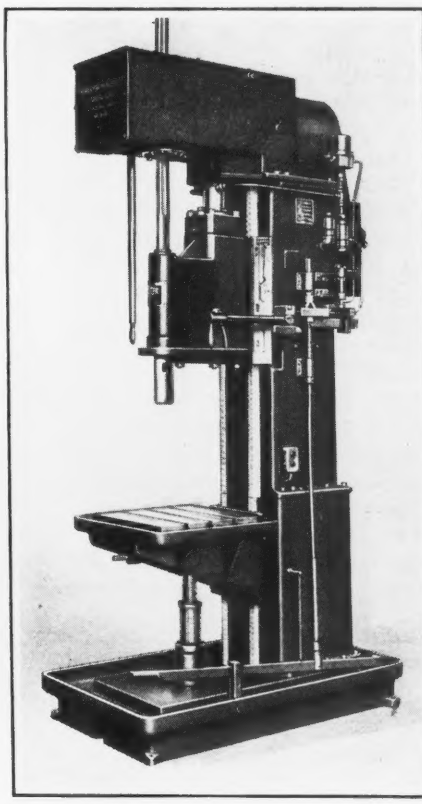
balance. A weighing mechanism shows direct the amount of metal to be removed in order to balance a given part. Excess stock is removed by the motor-driven drill spindle. As the machine is not affected by vibration, it can be set up in any part of a shop.

FARREL-BIRMINGHAM 1500-TON HYDRAULIC PRESS

The 1500-ton hydraulic press shown in the illustration was recently built by the Farrel-Birmingham Co., Ansonia, Conn., for use in a new tank department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.



Large Farrel-Birmingham Hydraulic Press Designed for Flanging and Forming Heavy Metal



Master Drilling Machine with Hydraulic Feed for the Drill Head

This press will be used for hot-forming ends of tanks and similar work, being especially designed for flanging or forming heavy metal parts.

The main ram of this press, which is 34 inches in diameter, exerts a pressure of 1000 tons. In addition, there are two 18-inch auxiliary rams which provide a pressure of 250 tons each. The press can, therefore, be used as a triple capacity machine, that is, for operation at a pressure of 500 tons, 1000 tons, or 1500 tons. Also, 500 tons pressure can be applied for clamping work and 1000 tons for drawing. In such a case, the 34-inch ram operates through guides on the moving platen.

This equipment measures 97 by 85 inches clear between the tie-rods, has a maximum opening of 72 inches, and a stroke of 48 inches. The over-all height from the floor to the top of the machine is 13 feet 8 1/2 inches, and the machine extends below the floor 20 feet 11 1/2 inches, making a total over-all height of 34 feet 8 inches. The floor space occupied is 13 feet 3 inches by 9 feet 6 inches.

Auxiliary lifting rams prefill the main cylinders with water from the surge tank. The lifting cylinders operate the moving platen and the main ram either together or separately. All return strokes are accomplished hydraulically. A 250-ton knock-out cylinder is located in the top platen.

MASTER HYDRAULIC DRILLING MACHINE

Hydraulic equipment is employed to actuate the drill head of the Master drilling machine here illustrated which was recently developed by the Superior Machine Tool Co., Kokomo, Ind. The machine may be arranged for either full- or semi-automatic operation. In full operation, the drill head operates constantly on the following cycle: Quick traverse downward to bring the drill to the work, slow feed at the desired rate for drilling, and quick return to the starting position. In the case of semi-automatic operation, the machine must be tripped by hand to start each

new cycle after the drill head has been returned to the starting position.

The successive steps in the cycle of feeding movements are controlled by cams at the back of the drill head. These cams engage a roller attached to a link mechanism that controls the flow of oil to the hydraulic cylinder. A foot-treadle connected to this control mechanism constitutes a safety device which enables the operator to disengage the hydraulic feed instantly whenever he desires to do so. With the treadle pushed down, the operator uses his hand to pull back a pistol grip and withdraw the roller from engagement with the cams, thereby disengaging the hydraulic feed.

The cylinder and piston of the hydraulic system are contained within the drill head. It will be seen from the illustration that the piston-rod extends upward and is secured to the frame of the machine. Two channels in the piston-rod lead to the respective sides of the piston, so that oil under pressure may be admitted on either side to produce the downward and upward movements of the drill head. Power for driving the Oilgear pump of the hydraulic system is delivered through a chain from a shaft which transmits the drive from the motor on top of the column to the spindle speed-change gears.

Although the machine is shown provided with the hydraulic equipment, it is also available with geared feeds. With the hydraulic system, feeds from 0 to 15 inches per minute are available, while the geared system provides feeds from 0.005 to 0.105 inch per spindle revolution. The rapid traverse is at the rate of 70 inches per minute. Spindle speeds ranging from 68 to 842 revolutions per minute are obtainable. This machine is built in 20-, 25-, and 30-inch sizes for drilling holes in alloy steel up to 1 1/2, 2, and 2 1/2 inches, respectively. The weights of the three sizes are 2500, 3600, and 4700 pounds.

MILBURN TWENTY-TANK MANIFOLD

A twenty-tank manifold intended for use as a central source of supply for oxy-acetylene cutting and welding torches has been placed on the market by the Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore, Md. This manifold makes it unnecessary to transport the oxygen and acetylene cylinders about the plant, and thus saves time and labor. With this equipment, it is possible to maintain a uniform pressure for all operations. Each tank or each side of the manifold can be operated independently through separate shut-off valves, so that the torches may be in operation while the tanks are being connected or disconnected.

NILES LOCOMOTIVE-AXLE JOURNAL GRINDER

Locomotive-axle journals may be both turned and ground in a machine recently brought out for the railway field by the Niles Tool Works Co., Hamilton, Ohio. This machine is arranged with a combination grinding and cutting rest for refinishing inside journals, and it can also be supplied with a similar rest for refinishing outside journals. The grinding and cutting units can be used separately or together.

The grinding unit is located at the rear of the rest, and the cutting tools at the front. The cutting tools are essential for facing hub liners and taking an initial

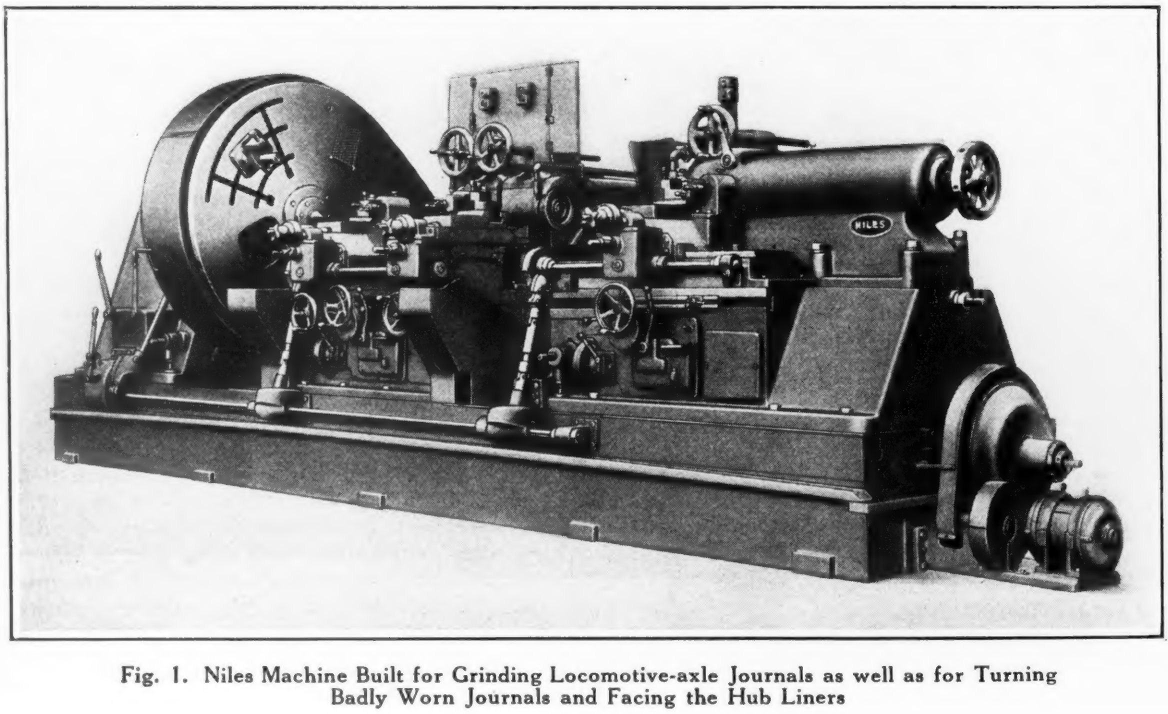


Fig. 1. Niles Machine Built for Grinding Locomotive-axle Journals as well as for Turning Badly Worn Journals and Facing the Hub Liners

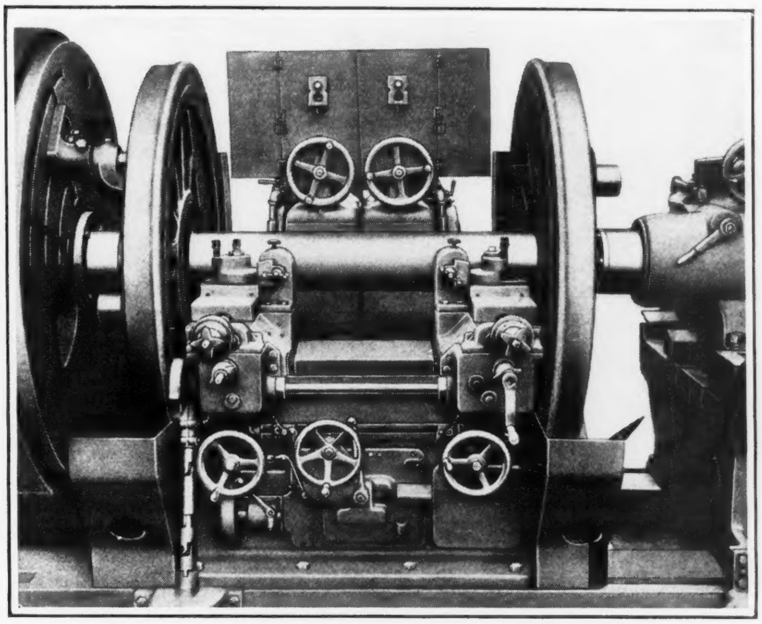


Fig. 2. Close-up View of Machine with Driving-wheel Set in Place

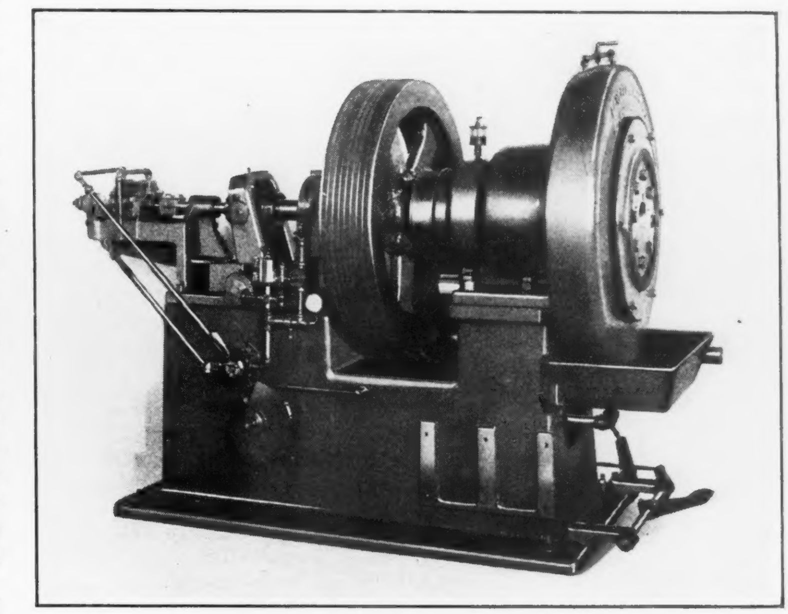
cut over badly worn journals to lessen the material to be removed by grinding. Wheel sets having 90-inch diameter drivers can be accommodated, and inside journals from 12 to 18 inches in length can be ground. With wheel sets having journals of average length, the floor-to-floor time is about thirty minutes.

LANGELIER SEMI-AUTOMATIC OPENING-DIE SWAGING MACHINE

A rotary swaging machine designed primarily for compressing the pocket end of copper terminals on the ends of insulated flexible wire cables has been developed by the Langelier Mfg. Co., Providence, R. I. Eleven sizes and two types of terminals are swaged on the cable.

In this work, the operator slips the pocket end of the terminal over the cable and then places the terminal between the open dies, inserting the blade end into a slotted stationary mandrel at the rear of the dies. He then trips a foot-pedal to start the machine. After the swaging is completed, the operator removes the terminal and then goes through the same procedure to swage a second terminal on the other end of the cable. For tubular terminals, there is a spring collet that is opened and closed by compressed air.

The swaging head is of special construction, with a mechanism inside the spindle for opening the dies sufficiently to permit the largest terminal to be inserted while they are revolving.

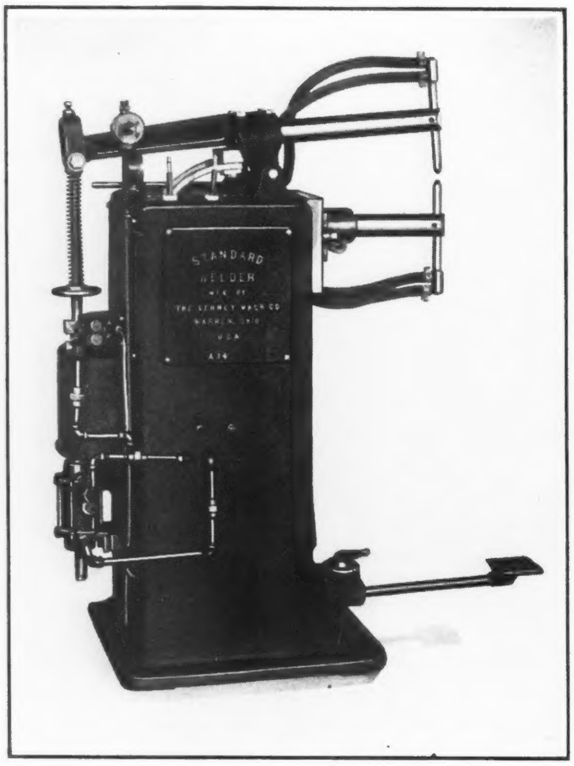


Langelier Swaging Machine Designed Primarily for Attaching Terminals to Wire Cables

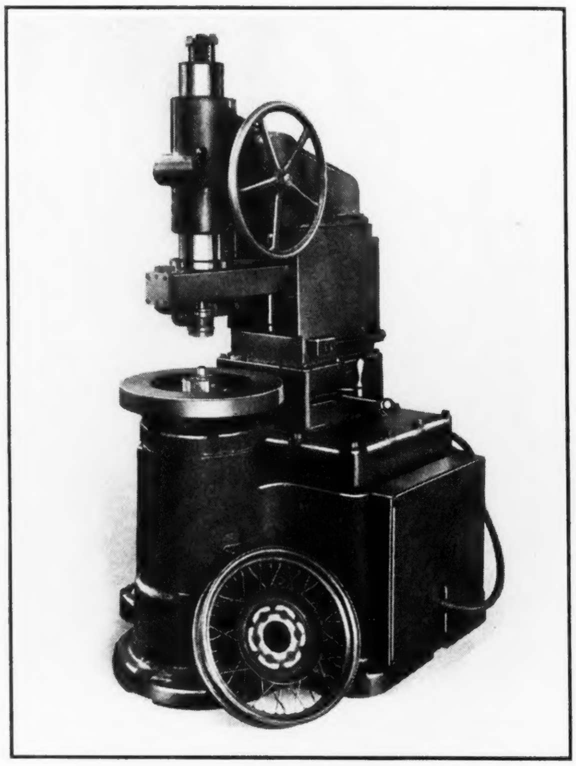
The main spindle has an enlarged end across which a rectangular slot is milled. The dies and hammer blocks are a sliding fit in this slot, the dies being in the inner position at the center of the spindle and the hammer blocks in the outer position. A circular ring containing twelve rolls surrounds the enlarged spindle end. When the spindle revolves, centrifugal force causes the dies and hammer blocks to move outward in the slot and come into contact with the rolls, with the result that the dies open and close on the work very rapidly. The flywheel is driven through eight Gilmer V-belts by a 15-horsepower motor.

AIR-O-MATIC SPOT-WELDING MACHINE

An air-operated spot-welder, which has recently been added to the line of "Standard" welding machines built by the Lenney Machine & Mfg. Co., Warren, Ohio, can be run at any number of strokes from 20 to 180 per minute. This machine is equipped with an automatic pressure valve and operates on an air pressure of 75 pounds per square inch. The operation is entirely automatic, the piston always coming to a stop with the welding points



Air-operated Spot-welder which can be Run at from 20 to 180 Strokes per Minute



Ex-Cell-O Machine Designed for Boring, Forming and Facing Wire Wheels

open. Tripping of the foot-lever causes the machine to make one piston stroke only, but by holding the lever down, the machine can be made to operate continuously if required.

This welder is so designed that on the lower speeds the down stroke of the electrodes is very slow and the return stroke fast, so that the welding time is unusually long. This feature is particularly valuable when a relatively slow operation is required with accurate timing of the contact period. The design is compact, the machine requiring only the floor space of foot-operated welders of the same capacity. It is built in two types having a range of from 13 to 33 kilovolt-amperes.

EX-CELL-O WIRE-WHEEL BORING, FORMING AND FACING MACHINE

A semi-automatic machine for boring and turning steel wire wheels to two diameters, forming two peripheries, and machining the hub face has been brought out by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. In an operation on this machine, the wheel is placed on the rotating table, where it is centered by a shouldered pilot in the upper vertical unit. This unit is traversed rapidly downward, by means of a large manually operated handwheel, to an indicated stop, where it is locked. The pilot is mounted in ball bearings and is backed up by a heavy spring which exerts the required pressure to hold the wheel in place. The stop consists of a roller that rides on the hub of the wheel and enables the operator to set the cross-slide of the upper vertical unit to remove the minimum amount of stock necessary to true the hub.

With the upper vertical unit in this position, the feed is thrown in by means of a hand-lever. The cross-slide then finishes the hub face and forms the periphery of the hub flange to a radius. Simultaneously, the lower vertical unit is fed up to bore the opposite end of the hub with a circular form tool. The lower unit feeds until the boring is completed, at which time a roller comes in contact with the lower face of the hub. A chamfering tool, which is fed in horizontally at this point, is kept true with the lower face of the hub by this roller. When the chamfer has been completed, the lower unit comes to rest at the bottom of its stroke and the upper unit is returned to its starting position, after which the wheel is removed.

GENERAL ELECTRIC HEAVY WELDING ELECTRODE

A new heavily coated welding electrode designated as the Type R is a recent product of the General Electric Co., Schenectady, N. Y. This electrode consists of from 0.13 to 0.18 carbon steel covered with a heavy coating of cotton braid that is impregnated with an arc stabilizing flux. It will be available in diameters of

from 1/8 to 3/8 inch and in a length of 18 inches. Metal deposits of this electrode have a high tensile strength and produce a homogeneous structure which results in a ductile weld. This is due to the fact that during the arc transference period, the metal is in a protective atmosphere, because the electrode burns away quicker than the coating and excludes those elements in the atmosphere that cause undesirable results when an uncoated rod is used. The electrode is particularly suitable for use on such work as pipeline welding.

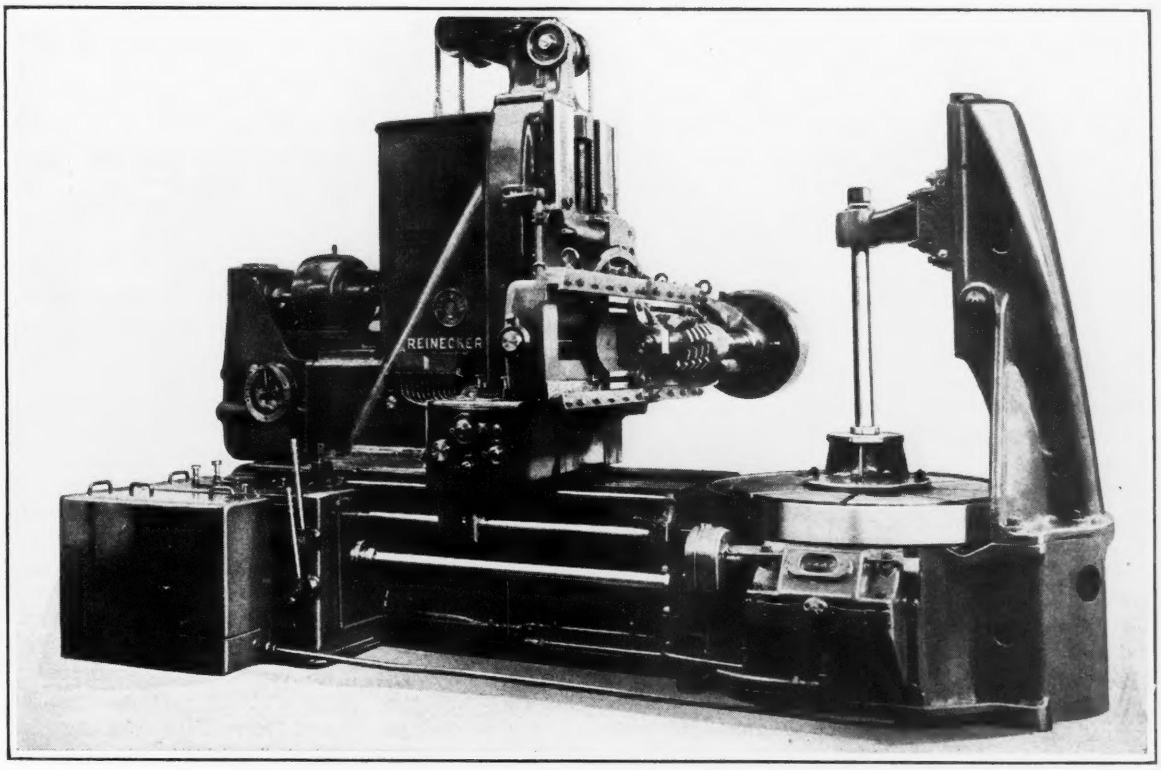
REINECKER WORM-GEAR HOBBING MACHINE

Spur, worm, and spiral gears up to 90 1/2 inches maximum diameter, 23 1/2 inches face width, and 3 inches circular pitch can be cut in the hobbing machine illustrated, which has been produced by J. E. Reinecker, Chemnitz, Germany, and is being placed on the American market by the George Scherr Co., 144 Liberty St., New York City. One of the principal features of this machine is that worm-gears can be cut by feeding the hob or a fly cutter tangentially along the revolving work. It is pointed out that this method is necessary for multiple-thread worm-gears having a helix angle greater than from 6 to 8 degrees, because when the radial or in-feed hobbing method is employed for gears having a larger helix angle, the tooth flanks are partly destroyed by the hob and will not have a full bearing with the worm. Worm-gears with the axes inclined as much as 25 degrees in relation to the corresponding worm axes can be cut on this machine. The in-feed hobbing method can also be used for worm-gears having a smaller helix angle.

Another advantage of the tangential feed method is that when small lots of worm-gears are to be cut or time is a factor, accurate results can be obtained by using a simple fly cutter. When a hob is used, it is usually of a tapered design. (The tangential feed method of cutting worm-gears is described in detail in the book "Gear Cutting Processes," by Franklin D. Jones.)

In cutting worm-gear teeth by the radial or in-feed method, the machine is so geared that the work and hob revolve in accordance with the ratio between the number of teeth in the worm and the number of teeth in the worm-gear. However, with the tangential feed method, the ratio must be altered slightly, so as to cause the cutter to follow a helical path across the work. Differential gearing contained in the compartment at the left-hand end of the bed provides the additional movement required for the table.

The machine is driven by a 15-horsepower motor, mounted on the horizontal extension at the back of the upright. Eighteen cutter spindle speeds ranging from 15 to 101 revolutions per minute are available through gears in a box beneath the motor. The drive to the cutter-head, dividing wheel, and feed is transmitted through a mechanism within the upright, and it is so arranged that it gives a large



Reinecker Hobbing Machine on which Tapered Hobs or Fly Cutters can be Fed Tangentially for Cutting Worm-gears

swiveling range of the cutter-head (25 degrees each side of the horizontal). Twenty-four feeds from 0.006 to 0.327 inch per cutter revolution are obtained by means of the gear-box on the side of the upright. The indexing gears, feed gears, and differential gears are independent of each other so as to eliminate difficult calculations.

Rapid traversing of the upright in or out, rapid return of the cutter-head up or down, and return of the tangential feed slide, are obtained by means of a separate five-horsepower motor located on the right-hand side of the bed. There is an automatic lubricating system driven by a 1/3-horsepower motor. The machine weighs 31,000 pounds.

LANDMACO THREADING MACHINES

A Landmaco threading machine, now being placed on the market by the Landis Machine Co., Inc., Waynesboro, Pa., is made in single- and double-head models and in 1- and 1 1/2-inch sizes. This machine is of a new design, in which strength, rigidity, wearing qualities and the ability to produce accurate screw threads were the main objectives. It is equipped with the Landco die-head.

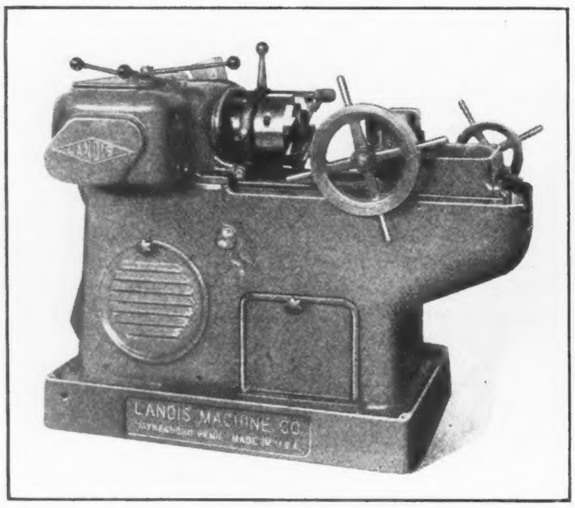


Fig. 1. Landmaco Threading Machine Built in Single- and Double-head Models

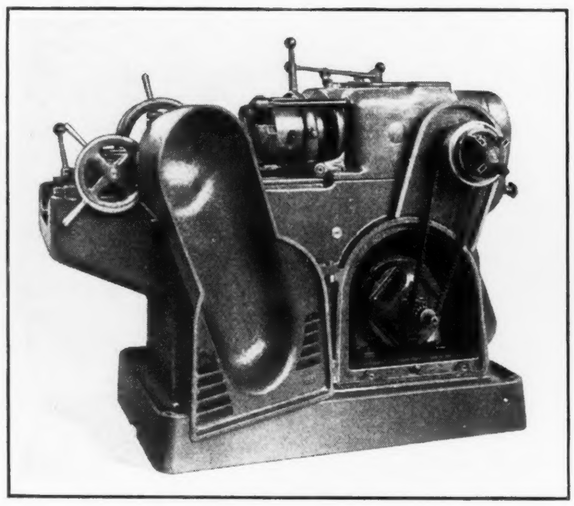


Fig. 2. View of Motor-driven Style, Showing Motor Located in the Base

The single-pulley drive includes a friction clutch for starting and stopping the machine. This clutch is adjustable and is mounted on the outer end of the main drive shaft, where it is readily accessible. Eight speeds are available through a selective-type gear-box, a wide range making possible efficient threading speeds on all materials and for all work diameters within the capacity of the equipment. The gear-box is integral with the headstock and is fitted throughout with anti-friction bearings. Chrome-nickel steel gears mounted on heat-treated alloy-steel shafts are used, as in high-grade machine tool construction. The bearings and gears are lubricated automatically by a flood system.

Double-head machines, when equipped with lead-screws, are provided with a mechanism in the gear-box for reversing one spindle. This mechanism can also be supplied for machines without lead-screws. The spindle is driven by spiral bevel gears. The bearings at the die-head end are unusually large, and are pre-loaded to eliminate end play, which would otherwise develop through wear. The die-head is located close to the front spindle bearing so as to reduce overhang to the minimum. Opening of the die-head is effected through a yoke by the forward movement of the carriage, and the head is closed as the carriage is withdrawn. The yoke is also equipped with a lever for opening and closing the die-head by hand.

The carriage may be operated either by a rack and pinion or by a lever. Guards attached to the front of the carriage and wipers located at the rear completely protect the guides. The guards pass under the headstock and the wipers are adjustable for wear. Lubricant is supplied to the guides by felt pads located in the carriage base. The vise may be adjusted transversely and vertically to maintain alignment between the die-head and the work. The heavy rim of the vise handwheel acts as a flywheel to reduce the effort required for gripping work.

The lead-screw, which is optional, is located centrally between the guides of the machine and takes the thrust load without causing binding of the carriage. It is mounted on preloaded ball bearings which automatically eliminate end play. The lead-screw has a coarse-pitch thread with a round crest that facilitates engagement with the nut. A steel tube protects the lead-screw from chips and dirt.

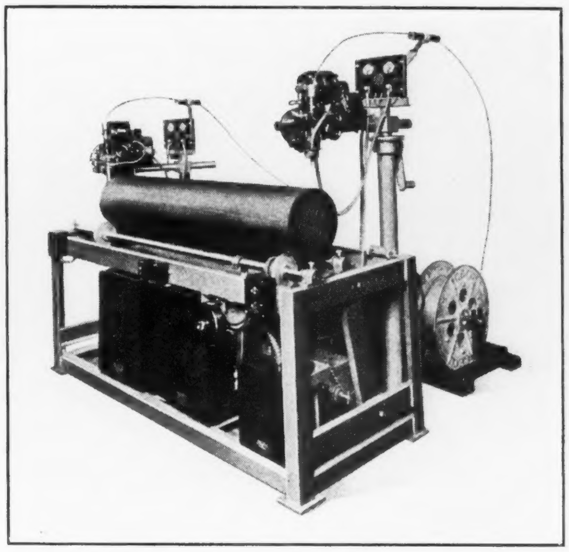
The pitch-change gears are housed in a gear-box located at the headstock end of the ma-

chine. The intermediate gears are carried in a circular slot in the base of the gear-box in a way that insures a rigid support for the entire gear train. When the machine is motor-driven, the motor is mounted in a compartment in the bed, as shown in Fig. 2, and connected to the main drive shaft by a silent chain.

GENERAL ELECTRIC RANGE-BOILER WELDERS

Two automatic arc-welding machines have been developed recently by the General Electric Co., Schenectady, N. Y., for use in the construction of range boilers and small tanks. One of these machines is designed for welding longitudinal seams, and the other (shown in the illustration) for welding circular seams. Tanks from 11 to 33 inches in diameter and up to 6 feet in length, can be handled with this equipment.

Both machines are made up of the standard units used in other automatic arc-welding equipment manufactured by the company, with the exception of the framework for holding the tanks. The machine used for welding longitudinal seams is especially designed to facilitate rapid production, being provided with a pneumatic clamping device operated by a small lever for gripping or releasing the work automatically. The machine employed for welding circular seams revolves the work automatically while both ends of the tank are being welded.

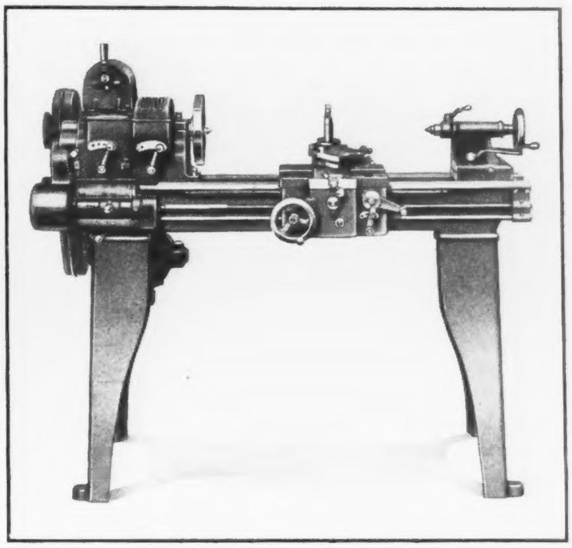

Automatic Arc-welder Built by the General Electric Co. for Welding Seams of Tanks

LE BLOND "REGAL" LATHE

An engine lathe designed for the light manufacturing, repair, and maintenance fields, as well as for use in schools, experimental laboratories, garages, etc., is the latest addition to the line of machines built by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. The "Regal" lathe, as the machine is called, is manufactured in five sizes ranging from 10 to 18 inches. It is equipped with an eight-speed selective geared headstock which is driven by a self-contained motor located at the rear of the headstock leg. Power is transmitted from the motor to the machine through multiple V-belts. Spindle speeds are obtained through sliding gears without the use of jaw clutches. The headstock shafts revolve in bearings lubricated by oil that is filtered through felt.

The lathe has been designed throughout with a view to making it as fool-proof as possible. The feed mechanism is strengthened wherever excessive strains may occur from the machine being run by inexperienced operators and a safety pin is provided in the feed-gear train. The feed mechanism includes the quick-change box and apron employed on LeBlond heavy-duty engine lathes. A positive pinion type of clutch guards against accidental engagement of the feed.

The rear vee on the bed keeps the headstock and tailstock in accurate alignment, whereas the front vee is used to guide the carriage. Wipers on the carriage wings protect the carriage and bed from dirt and grit. The design of the tailstock is such that the compound rest may be used parallel to the tailstock spindle. The collar on the cross-feed screw is graduated to obtain movements of 0.001 inch, and the compound rest swivel-slide is graduated in degrees. The latter may be set at right angles to the cross-slide or to any angle for boring short steep tapers. The screw for the top slide is also provided with a collar that is graduated to obtain movements of 0.001 inch.


Le Blond "Regal" Lathe Built in Five Sizes Ranging from 10 to 18 Inches

The drive to the feed train is through a gear on the spindle, a reverse plate which carries two tumbler gears, and a reverse plate gear that swivels on the headstock casting. The feed can be reversed by means of the tumbler gears, and the lead-screw can be reversed by the reverse plate for cutting right- or left-hand threads. Twenty-four feed and thread changes are obtainable through the two levers on the quick-change box, and forty-eight by means of the slip gear on the quadrant.

WOOD'S GRINDER FOR TUNGSTEN-CARBIDE AND HIGH-SPEED STEEL TOOLS

A grinder designed for sharpening tungsten-carbide tipped tools, as well as high-speed steel tools, is being introduced to the trade under the name "Universal Giant," by the T. B. Wood's Sons Co., Chambersburg, Pa. An important feature of this machine is the provision of a reversing type ball-bearing motor by means of which the two grinding wheels may be driven in either direction. Thus, right- or left-hand tools can be sharpened with the tungsten-carbide insert or tip always on top in plain view of the operator. With this arrangement, the wheel, in each case, rotates toward the cutting edge rather than away from it, with the result that the tip can be sharpened to a razor edge.

The machine is equipped with two tilting tables which may be set accurately to the required angle by means of a quadrant and indicator. In addition, there is a tool guide mounted on a straightedge, which may be moved in slotted ways parallel with the edge of the grinding wheel. This tool guide may be set at any angle with the grinding wheel required for handling the work by adjusting a protractor integral with the guide.

The wheels are 12 inches in diameter and are made especially for grinding tungsten carbide, but they may also be used for all kinds of high-speed steel. Sharpening is done on the edge of the wheel rim, the velocity always being about 5600 feet per minute. Wheels of different grains are provided, so that tools may be rough- and finish-sharpened without making any changes in the machine.

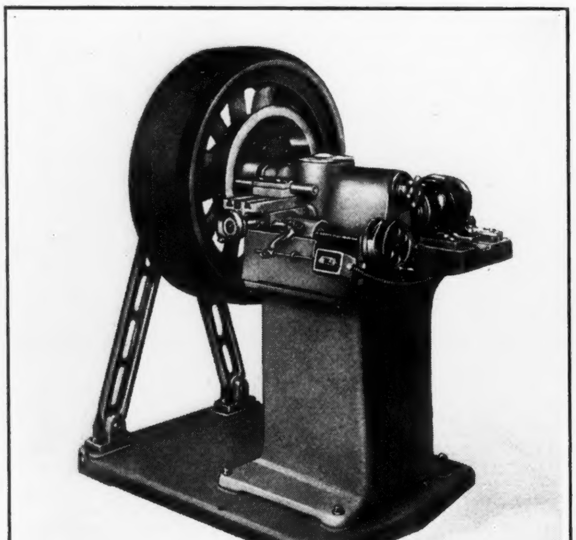
Although the illustration shows a machine equipped with a 1 1/2-horsepower motor, which runs at 1800 revolutions per minute, a pulley and reversing countershaft can be provided instead. The spindle of both the motor- and belt-driven machines is equipped with ball bearings provided with dust seals.

RAYBESTOS "SUPER" DRUM LATHE

Lathes of special design for refacing and truing scored, concave, and out-of-round brake-drums of automobiles, motor trucks, and buses are built by the Reed-Prentice Corporation, Worcester, Mass., for Raybestos-Manhattan, Inc., Bridgeport, Conn. The illustration shows the Model D machine, which is intended for handling the wheel assemblies of passenger cars and trucks. A Model C machine is built for passenger cars only, this model being made without the outboard support or the extended base. There is also a Model E machine intended primarily for trucks and bus brake-drums.

Arbors and bushings are provided to suit the wheel assemblies to be handled. The use of a rubber driving belt and worm-

Grinder with Reversing Motor for Sharpening Tungsten-carbide Tools



Machine Built by the Reed-Prentice Corporation for Reconditioning Brake-drums

gearing insures a smooth drive. Three speeds are available for drums of different diameters. There are five feeds ranging from 0.003 to 0.015 inch per work revolution. The speed and feed mechanisms are driven by the same 3/4-horsepower motor.

HUNTER HIGH-SPEED METAL CUT-OFF SAW

The No. 6 high-speed metal cut-off saw here illustrated is being introduced to the trade by the Hunter Saw & Machine Co., 5662 Butler St., Pittsburgh, Pa., for cutting off light steel tubes, shapes, and similar work. It is also made in two additional types, the No. 6A for cutting brass and copper bars, shapes, and tubing, and the No. 6B for cutting aluminum.

The type intended for cutting steel is equipped with a 5-horsepower motor and 18-inch toothed saws; the type intended for cutting brass and copper, with a 3-horsepower motor; and the type intended for cutting aluminum, with a 1/8-horsepower motor. The two latter types have 14-inch toothed saws. The 1/8-horsepower motor drives a coolant pump which is not required in cutting steel. This pump is mounted on a self-contained reservoir underneath the table. Although the machine is equipped with saws of the sizes mentioned, saws of any size from 10 to 18 inches can be used.

In this machine, the motor and saw arbor are mounted on opposite ends of a balanced swing frame and the saw blade is driven by positive V-belts. The saw blade is pulled through the material being cut by a hand-lever. The drawer-type chip pan underneath the table can easily be pulled out for cleaning.

MOTOR-DRIVEN BENCH MILLING MACHINE

A motor-driven bench milling machine has recently been developed by Hardinge Bros., Inc., 4147-49 Ravenswood Ave., Chicago, Ill., as a companion machine to the Cataract motor-driven bench lathe. Among the features of the new milling machine are a fully enclosed headstock and a V-belt drive throughout. There is a six-speed transmission in which the high and low speeds are controlled by a clutch. Additional speeds are obtained by shifting one belt. The drive unit is mounted under the bench, thus eliminating overhead shafts and belts.

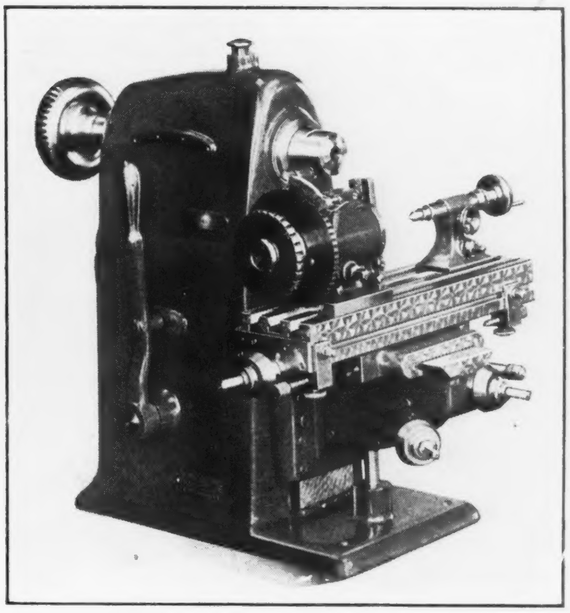
Left-hand cutters can be used in this machine by applying a reversing type of switch to a standard reversible motor. The collets can be interchanged between the cutter-head and the dividing head, and they can also be used in the No. 4 bench lathe.

The important specifications of this milling machine are as follows: Working surface of table, 12 by 3 1/8 inches; longitudinal table travel, 5 1/2 inches; transverse table travel, 4 inches; vertical table travel, 6 1/2 inches; range of speeds, 240 to 1725 revolutions per minute; and weight, 105 pounds.

OILGEAR CONSTANT-PRESSURE PUMPS

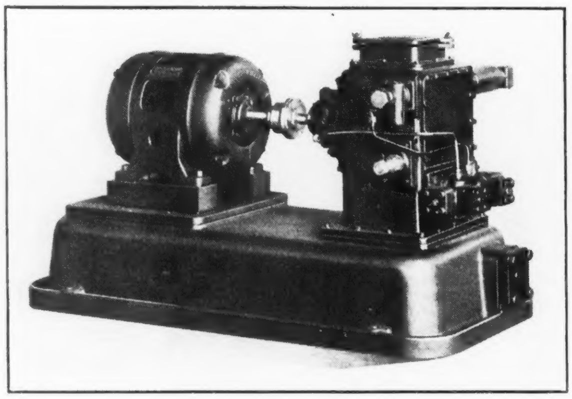
Type WES constant-pressure pumps are being manufactured by the Oilgear Co., 1306 W. Bruce St., Milwaukee, Wis., with an improved high-pressure variable-delivery pump unit and an improved pendulum assembly which has a direct suction. The Type WES-5 pump has a maximum displacement of 3600 cubic inches of oil per minute, when operated at a constant speed of 860 revolutions per minute; the Type WES-6 has a maximum

Hunter Cut-off Saw Made in Different Types for Cutting Steel, Brass, Copper, and Aluminum



Cataract Bench Milling Machine Designed to be Driven by a Unit under the Bench

displacement of 3400 cubic inches of oil per minute, when operated at a constant speed of 600 revolutions per minute; and the special Type WES-6 has a maximum displacement of 4800 cubic inches of oil per minute, when operated at a constant speed of 860 revolutions per minute. The maximum pressure recommended for all types is 1000 pounds per square inch.



Oilgear Constant-pressure Pump with Variable-delivery Unit

Typical applications of these pumps include horizontal and vertical honing machines, presses, die-casting machines, large furnace-door pushers, etc. The pumps are all equipped with automatic constant-pressure type controls by means of which the maximum pressure can be maintained indefinitely without overheating, loss of power, or attention on the part of the operator.

The pressure can be released instantly by simply by-passing the oil. A peak relief valve installed inside the pump casing protects the work, machine, and pump from overload. There is a small auxiliary gear pump built into the drive-shaft end casing, which supercharges the high-pressure unit at all times. The high-pressure unit operates at 4300 piston strokes per minute. The net weight of the pump is 600 pounds.

WELLS SHARPENING MACHINES FOR KEYSEAT CUTTERS AND TAPS

Two more machines have been added to the cutter-sharpening equipment made by the Wells Mfg. Co., P. O. Box 613, Greenfield, Mass. Fig. 1 shows one of these new machines, which is designed for sharpening the teeth of keyseat cutters on their faces with any desired amount of under-cut. Teeth can be ground alternately at different angles for breaking up the chips. The cutter is fed by hand against the grinding wheel, a spring being used to locate each tooth as it is ground. All machine movements are swinging motions. A 1/4-horsepower motor drives the equipment.

Fig. 2 illustrates a machine designed for sharpening hand taps from 1/4 to 1 inch and pipe taps from 1/8 to 2 inches. Machine-screw taps as small as No. 6 can also be accommodated. In addition to taps, reamers may be sharpened in this machine. They may be ground round on the point and with eccentric relief.

Although the standard machine is designed for tools up to 7 inches in length, machines can be furnished for tools 12 1/2 inches long. Cams can be provided to suit any number of flutes. A diamond truing device is included for dressing the wheel. This machine is driven by a 1/4-horsepower motor.

DEVILBISS ELECTRO-VISCOMETER

An electric viscometer for rapidly measuring the viscosity of paints, varnishes, lacquers, oils, and similar liquids has been developed by the DeVilbiss Co., Toledo, Ohio. This device measures viscosity by rotating an impeller in the liquid, and shows the liquid consistency on a dial. The effect of the viscosity load imposed by the liquid on the impeller is determined by the effect upon the electric circuit of the rotor which drives the impeller. Measurements of viscosity can easily be made in the original container of the liquid.

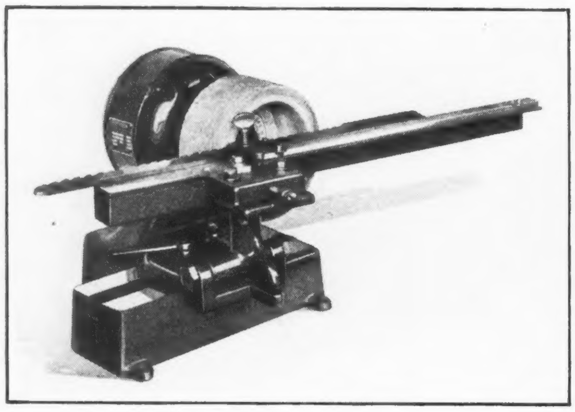


Fig. 1. Wells Hand-operated Sharpening Machine for Keyseat Cutters

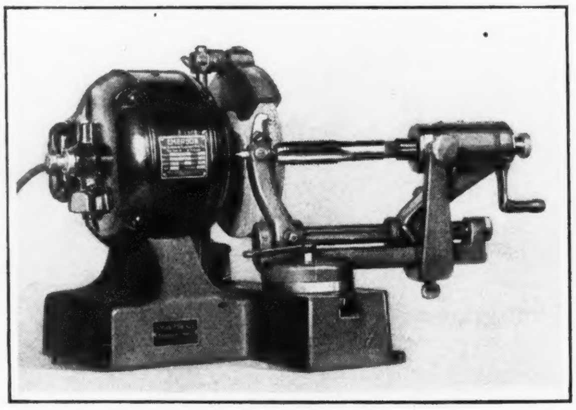
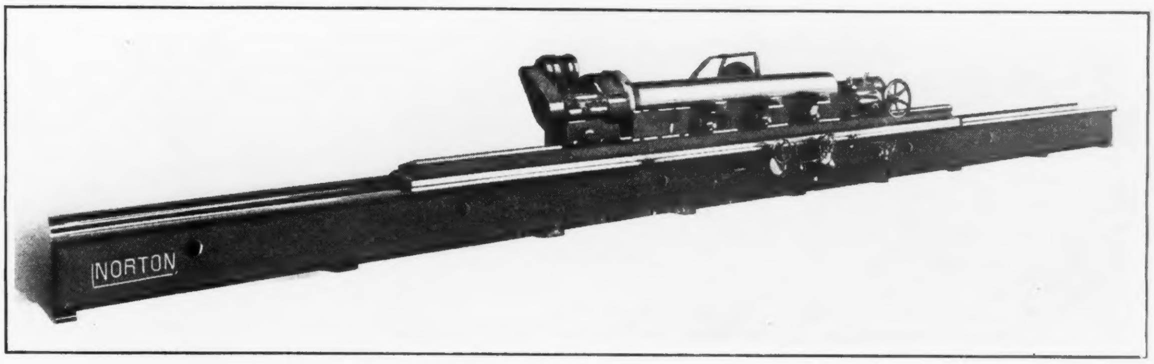


Fig. 2. Bench Machine Designed for Sharpening Taps and Reamers



Norton Grinder with Traversing Table which Takes Work up to 36 Inches in Diameter and 24 Feet Long

HUGE NORTON GRINDING MACHINE WITH TRAVERSING TABLE

What is believed to be the largest grinding machine in the world equipped with a traversing table has just been completed by the Norton Co., Worcester, Mass. This machine will grind work up to 36 inches in diameter and 288 inches in length. The limit of allowable weight is 40.000 pounds. It will grind to within 0.0005 inch of concentricity and straightness. In a trial, stock was removed from a large cast-iron column at the rate of 6 cubic inches per minute.

The machine was built for the Southwark Foundry & Machine Co., Eddystone, Pa., and will be used principally to grind rams and columns for big hydraulic presses. It will finish-grind direct frcm rough-turned surfaces and thus effect a considerable saving over the method formerly used.

The fundamental principles of design are the same as in all other Norton cylindrical grinding machines. The work is driven by a headstock equipped with a live spindle 10 inches in diameter and a ball-bearing assembly that measures 16 1/8 inches in diameter. A chuck on the headstock grips one end of the work, while the other end is supported by the center of a footstock. Centers 4 1/2 inches in diameter by 24 inches long are used.

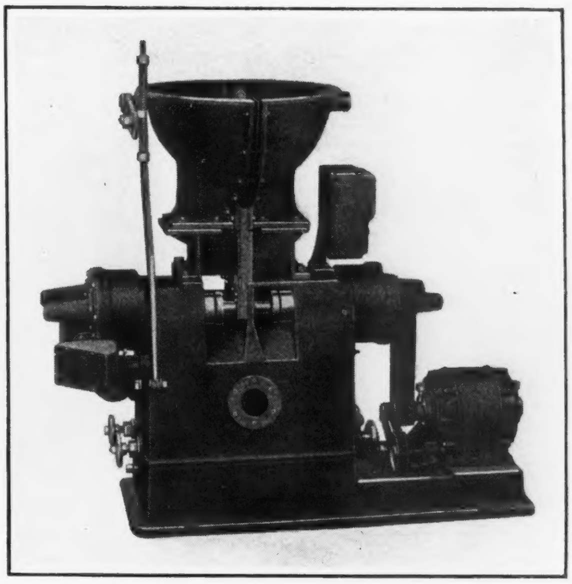
The headstock and footstock are adjustable along the heavy work-table. This table weighs 16,500 pounds, and was cast in a single piece with a view to obtaining maximum rigidity. Twelve table speeds are available and there is a patented interlocking device for the table drive.

The wheel-slide is supported on one flat way and one V-shaped way. The slide is actuated by a large feed-screw and half-nut lapped together. It is said that in spite of the tremendous weight of the slide, this unit can be adjusted into position within 0.000125 inch. There is provision for moving the slide in and out rapidly by power.

The base is 57 feet long, is made in three sections, and weighs 36,800 pounds. More than a ton of metal was removed in planing the three sections. Large journal rests having a capacity for work 30 inches in diameter are provided. A 30-horsepower motor delivers power for the wheel and table traverse, and a 20-horsepower motor actuates the headstock.

KENT DUPLEX NUT COUNTERSINKING MACHINE

Both ends of the hole in nuts from 1/2 to 1 inch in size can be countersunk simultaneously in a machine recently designed by the Kent Machine Co., Cuyahoga Falls, Ohio. The new machine operates on the same principle as the smaller machine built by the concern, although the design varies materially. It is of the duplex type, with one hopper feeding two sets of countersinking spindles on opposite sides of the machine. Each set consists of two opposed rotating and reciprocating spindles which carry the countersinking tools. One of the features of the machine is that irrespective of the nut thickness, the desired depth of countersink is obtained, because of a stock adjustment that has been provided.

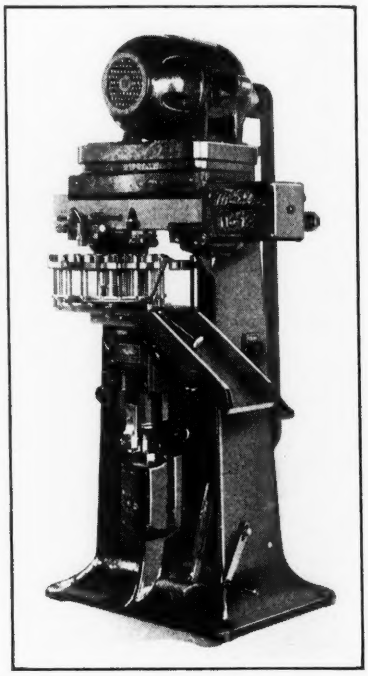


Kent Duplex Nut Countersinking Machine

Each nut is fed from the hopper through a

chute to a formed receptacle in which it is held while the countersinking takes place. Then the nut is ejected automatically from the holding receptacle, and a new nut is fed into place. The spindles and other working parts of the machine are controlled by one camshaft, located in the center of the machine between the countersinking spindles. Forced lubrication insures proper oiling of all bearings and working parts. Changes to accommodate different sizes of nuts can easily be made.

Each set of countersinking spindles makes 60 reciprocations per minute, giving a production of 7200 nuts per hour. A one-horsepower motor drives the camshaft through a belt, and the countersinking spindles are driven direct from this shaft.



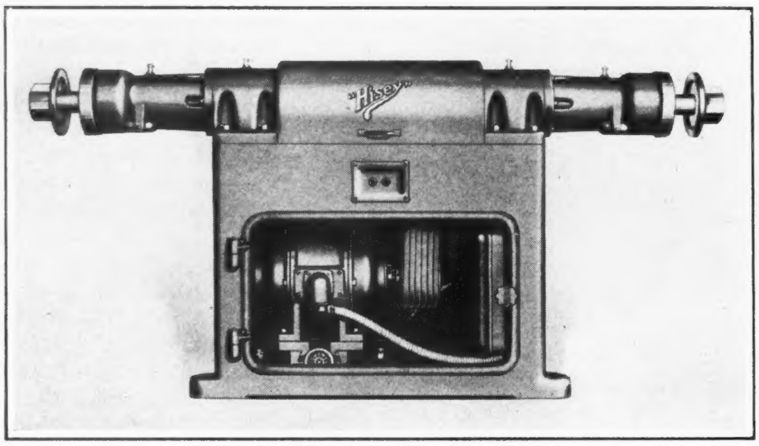
Martin Hydraulic Marking Machine with Disk Feed

HISEY "TEXDRIVE" BUFFING AND POLISHING MACHINES

Buffing and polishing machines of 10 and 15 horsepower ratings, equipped with a "TexDrive," have been added to the line of equipment manufactured by the Hisey-Wolf Machine Co., Cincinnati, Ohio. The over-all length of the spindle on these machines is 82 inches, and the length of spindle projection from each end is 15 inches. The machines weigh 2600 pounds.

These machines have a unit spindle-head construction. The motor is ball-bearing equipped. It is mounted horizontally on a dovetailed sliding base in the cabinet, and is adjusted by means of a handwheel and feed-screw. With this arrangement, it is easy to maintain belt tension and alignment.

Either four ball bearings or Timken tapered roller bearings can be supplied for the spindle head. The bearing boxes are keyed to the column to insure permanent alignment. The ends of the wheel-arbor are provided with flat top threads for holding the buffing wheels, and are fitted with bronze safety nuts that effectually protect both the thread and the operator.



Hisey Buffing and Polishing Machine Equipped with "TexDrive"

DISK FEED FOR MARTIN MARKING MACHINE

Through the use of a disk feed recently provided on a hydraulic marking machine built by the Martin Machine Co., Inc., Turners Falls, Mass., automotive engine valves are marked at the rate of about fifty per minute. This production is governed by the ability of the operator to load the valves, as the machine itself can be operated at a speed as high as sixty-three strokes per minute.

The valves are inserted in the disk at the front by hand and are automatically twirled out on the right-hand side. The disk rests on a ball thrust bearing and is revolved by the action of the table cylinder that operates the machine. A hardened anvil supports the disk under the point where the marking is done. Although the valves vary in thickness, a uniform impression is produced on them.

GENERAL ELECTRIC NITRIDING FURNACES

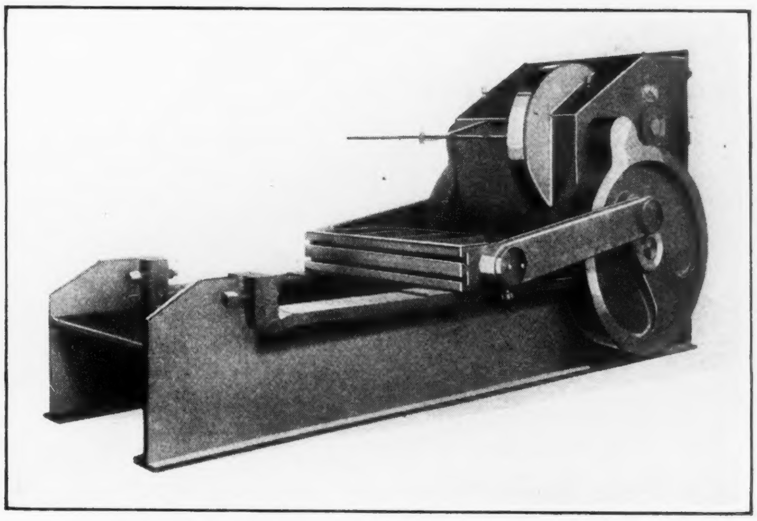
A line of batch-type nitriding furnaces brought out by the General Electric Co., Schenectady, N. Y., for use at temperatures up to 1200 degrees F., includes two sizes of vertical cylindrical-type furnaces and two sizes of box-type furnaces. The vertical furnaces consist of an outer shell which contains heating units of nickel-chromium resistor ribbon, and an inner retort which is inserted into the furnace through a hole in the cover. These furnaces are equipped with a fan for circulating the ammonia gas. The smaller of the two furnaces has loading dimensions of 14 5/8 inches in diameter by 18 inches in depth, while the larger furnace has loading dimensions of 20 1/2 inches in diameter by 26 inches in depth.

The box-type furnaces are equipped with charging trucks, a rack, and a roller track for handling the retort. The retort of the smaller box-type furnace is 19 1/2 inches wide, 48 inches long, and 11 inches high, and that of the larger furnace is 28 inches wide, 48 inches long, and 11 inches high.

BULLDOZER OF WELDED STEEL-PLATE CONSTRUCTION

Welded steel construction has been adopted in a line of "Battleship" bulldozers recently developed by the Steelweld Machinery Co., Cleveland, Ohio. The frame of these machines is made of steel plates and shapes, cut to size and welded together. Heavy members of rolled steel, which form the die-holding base, are carried back to the steel-jacketed main bearings. On these members are also mounted hardened and ground steel bearing plates on which the ram slides. The side arms are also made of steel. The advantages claimed for the welded steel construction include a reduction of upkeep costs and fewer mechanical failures.

The driving mechanism and the motor are entirely enclosed in the main frame. The motor transmits power through "cog belts." Timken roller bearings are provided in the flywheel and on the high-speed shaft. The ram T-slots are machined out of solid steel to avoid breakage in service. The main drive is equipped with a Twin Disc clutch, and reversing clutches are standard in the larger sized machines. An electrical clutch control can be supplied if desired.



Steelweld Bulldozer Constructed of Steel Plates and Shapes Welded Together

HASKINS SCREWDRIVING AND NUT-SETTING EQUIPMENT

Equipment developed by the R. G. Haskins Co., 4634 W. Fulton St., Chicago, Ill., for driving small screws and setting small nuts is shown in the accompanying illustration. This equipment includes a standard power unit consisting of a motor, clutch, and adjustable tension-controlling device. All bearings are of the combined radial and thrust ball type and are fitted with grease-retaining devices. A pair of gears gives the correct speed for the bit or wrench.

The tension-controlling device can be easily adjusted so as to drive screws or nuts to a uniform tightness. The flexible drive includes a hand-piece of a size and shape to fit the operator's hand. A quick-acting chuck permits rapid changing of bits or wrenches.

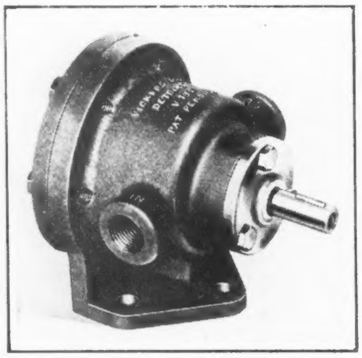
The mounting illustrated consists of a special cast-iron standard which can be mounted on a bench, conveyor, wall, or ceiling. A cast-iron fitting contains the ball-bearing swivel, while the connection between the fittings is heavy tubing. The unit is counterbalanced, so that practically no effort is required to center the driver over the screw or nut to be driven.

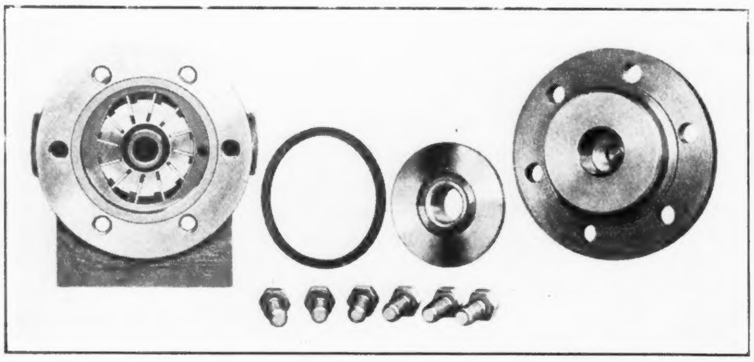
Haskins Equipment for Driving Screws and Setting Nuts

VICKERS ROTARY HYDRAULIC PUMPS

Two V-type rotary pumps having respective capacities of 15 and 30 gallons per minute at 1000 revolutions per minute are being introduced on the market by Vickers, Inc., 7752 Dubois St., Detroit, Mich. Among the advantages claimed for these pumps are high volumetric and mechanical efficiencies; a continuous working pressure of 500 pounds per square inch; a pressure of 1000 pounds per square inch for press work; long life; and quiet operation.

As indicated in the illustrations, all working parts can be readily removed from one end of these pumps without disturbing the motor connection or the





Figs. 1 and 2. Vickers V-type Rotary Pump for Feeding or Controlling Machine Units Hydraulically

pump piping. The harmonic curves in the ring at the ports are designed to give a balanced pressure on both sides of the vanes, so as to increase the mechanical efficiency and eliminate side thrust and consequent wear on the bearings.

All parts are interchangeable and larger capacities can be obtained by changing the internal parts. The rotor, ring, and vanes are made of alloy steel and are hardened and ground, while the port bushing and flange bushing are made of hydraulic bronze. The body is a nickel-iron casting. The packing is not under oil pressure in this design, and the body is completely drained to eliminate oil leakage. The weight of these pumps is 32 pounds.

SWARTZ CLAMPING LOCK AND FIXTURES

A clamping lock intended for application to various types of jigs and fixtures has been developed by G. E. Swartz and is being manufactured by the Geo. A. Gloor Co., 6442 Epworth Blvd., Detroit, Mich. The illustrations show examples of the manner of mounting this clamping lock on fixtures. By simply moving the lever, parts can be quickly located and clamped. The locking action is automatic when the lever is operated, and there is a "direct-drive" design which insures that all the clamping effort is applied to the work.

This lock is made in three sizes, and can be assembled to fixtures by merely drilling and tapping three holes. All internal parts are hardened and ground. A weighted lever or mallet may be used on the operating lever without damaging the locking parts.

A line of Swartz standard drilling fixtures is also made by the same company. These fixtures are available in three open-side types and in one closed-end type, as well as in various sizes. All the fixtures are of a two-post design in which posts of large diameter provide liberal bearings. Flanged shoulders maintain the correct relation between the fixture head and the base under severe clamping conditions.

The line includes a Type L fixture which is arranged for solid clamping. A draw-rod, placed between the posts, operates the head to and from the clamping position, and a standard lock keeps the fixture clamped during the operation. The fixture head and operating lever will remain in any position to which they are advanced by the operator, leaving both of his hands free for loading.

The Type LS fixture employs the standard lock and a spring inside a case attached to the head-operating shaft. The spring provides a flexible clamping means. This fixture is especially suitable for drop-forged gear

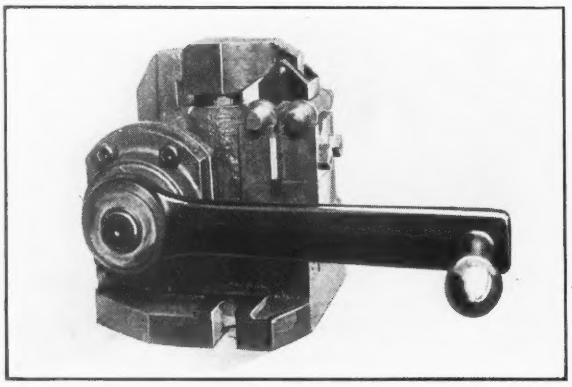


Fig. 1. Swartz Clamping Lock Applied to a Milling Fixture

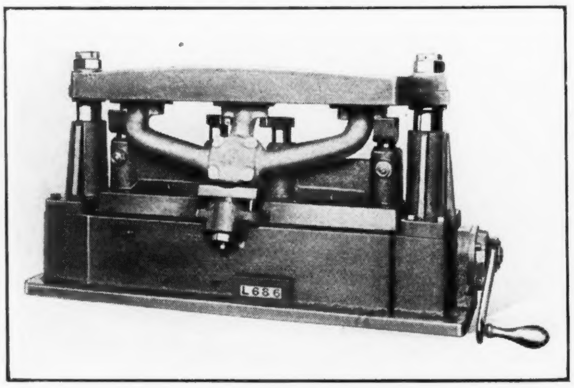


Fig. 2. Swartz Standard Drilling Fixture for an Intake Manifold

TABLES FOR BELT DRIVE CALCULATIONS

This Data Sheet and No. 198, together with Nos. 195 and 196 published in February MACHINERY, are for use as guides in designing belt drives.

Example—What weight of oak-tanned leather belt, 6 inches wide, will transmit 20 horsepower at a belt speed of 2400 feet per minute? The arc of contact on the pulley is 160 degrees.

Transmitting 20 horsepower with a 6-inch belt equals 20 ÷ 6 = 3.33 horsepower per inch of belt width.

Let T = tension on tight side of belt per inch of width, and t = tension on loose side of pulley per inch of width. Then $T - t$ = effective tension necessary to transmit the required horsepower. Thus,

$$T - t = \frac{\text{Horsepower} \times 33{,}000}{\text{Velocity of belt in feet per minute}}$$

or

$$T - t = \frac{3.33 \times 33{,}000}{2400} = 47 \text{ pounds, approximately}$$

The table below "Friction Coefficients for Belts on Pulleys" gives 0.25 as the coefficient of friction for oak-tanned belts on iron pulleys. Referring to Data Sheet No. 198, we find opposite angle $A = 160$ degrees and under $f = 0.25$, the value $C = 1.99$. The tight side tension is then found as follows:

$$T = C \times (T - t) = 1.99 \times 47 = 94 \text{ pounds}$$

In Data Sheet No. 195, February MACHINERY, the maximum tight side working tension T_m for a medium single 16-ounce oak-tanned leather belt is given as 100 pounds. This size of belt will, therefore, meet the requirements.

Example—Find the necessary width of a 10-ply 28-ounce canvas stitched belt for the same drive.

Referring to Data Sheet No. 195, in February MACHINERY, we find that this belt has a maximum tension value T_m of 240 pounds per inch of width and a friction coefficient of 0.20.

Data Sheet No. 198 gives 2.33 as the constant C for a belt having a coefficient of friction of 0.20 and an arc of contact of 160 degrees. The effective tension $(T - t)$ is then found as follows:

$$(T - t) = T_m \div C = 240 \div 2.33 = 103 \text{ pounds}$$

The horsepower per inch of width equals

$$\frac{2400 \times 103}{33{,}000} = 7.5$$

The width of belt required to transmit 20 horsepower then equals

20 ÷ 7.5 = 2.7 inches or, say, 2 3/4 inches, which is the nearest regular width.

FRICTION COEFFICIENTS FOR BELTS ON PULLEYS

Kind of Belt	Friction Surface of Pulley						
	Iron	Steel	Wood	Paper	Wet Iron	Greasy Iron	Oily Iron
Oak-tanned Leather.	0.25	0.25	0.30	0.35	0.20	0.15	0.12
Mineral-tanned Leather	0.40	0.40	0.45	0.50	0.35	0.25	0.20
Canvas Stitched	0.20	0.20	0.23	0.25	0.15	0.12	0.10
Balata	0.32	0.32	0.35	0.40	0.20	....	....
Cotton Woven	0.22	0.22	0.25	0.28	0.15	0.12	0.10
Camel-hair	0.35	0.35	0.40	0.45	0.25	0.20	0.15
Rubber-friction	0.30	0.30	0.32	0.35	0.18	....	....
Rubber-covered	0.32	0.32	0.35	0.38	0.15	....	....
Rubber on Fabric...	0.35	0.35	0.38	0.40	0.20	....	....

MACHINERY'S Data Sheet No. 197, New Series, March, 1931

Compiled from Data Furnished by the Dodge Mfg. Corporation

TRANSMISSION BELTING FACTORS FOR ARC OF CONTACT AND FRICTION COEFFICIENT

A = arc of contact of belt around pulley, in degrees;
f = coefficient of friction between belt and pulley;
T = tension on tight side of belt, per inch of width;
t = tension on loose side of belt, per inch of width;
$T \div t$ = ratio between tensions on tight and loose sides of belt;
$T - t$ = effective tension;
C = constant by which to multiply $(T - t)$ to obtain the tension on the tight side.

Angle	f = 0.10		f = 0.15		f = 0.20		f = 0.25		f = 0.30		f = 0.35		f = 0.40		f = 0.50	
A	T ÷ t	C	T ÷ t	C	T ÷ t	C	T ÷ t	C	T ÷ t	C	T ÷ t	C	T ÷ t	C	T ÷ t	C
30	1.05	19.51	1.08	13.29	1.11	10.00	1.14	8.14	1.17	6.88	1.20	5.97	1.23	5.29	1.30	4.34
40	1.07	14.88	1.11	10.90	1.15	7.66	1.19	6.23	1.23	5.29	1.28	4.61	1.32	4.10	1.42	3.39
50	1.09	11.98	1.14	8.14	1.19	6.23	1.24	5.09	1.30	4.34	1.36	3.82	1.42	3.39	1.55	2.82
60	1.11	10.00	1.17	6.88	1.23	5.29	1.30	4.34	1.37	3.71	1.44	3.25	1.52	2.94	1.69	2.45
70	1.13	8.63	1.20	5.97	1.28	4.61	1.36	3.82	1.44	3.25	1.53	2.87	1.63	2.58	1.84	2.18
80	1.15	7.66	1.23	5.29	1.32	4.10	1.42	3.39	1.52	2.94	1.63	2.58	1.75	2.33	2.01	1.99
90	1.17	6.88	1.27	4.75	1.37	3.71	1.48	3.08	1.60	2.66	1.73	2.36	1.87	2.14	2.19	1.83
100	1.19	6.23	1.30	4.34	1.42	3.39	1.55	2.82	1.69	2.45	1.84	2.18	2.01	1.99	2.39	1.71
110	1.21	5.71	1.33	4.02	1.47	3.13	1.62	2.62	1.78	2.28	1.96	2.04	2.16	1.86	2.61	1.62
120	1.23	5.29	1.37	3.71	1.52	2.94	1.69	2.45	1.87	2.14	2.08	1.92	2.31	1.76	2.85	1.54
130	1.26	4.92	1.41	3.46	1.57	2.74	1.76	2.31	1.98	2.02	2.21	1.82	2.48	1.67	3.11	1.47
140	1.28	4.61	1.44	3.25	1.63	2.58	1.84	2.18	2.08	1.92	2.35	1.73	2.66	1.60	3.39	1.41
150	1.30	4.34	1.48	3.08	1.69	2.45	1.92	2.08	2.19	1.83	2.50	1.66	2.85	1.54	3.70	1.36
160	1.32	4.10	1.52	2.94	1.75	2.33	2.01	1.99	2.31	1.76	2.66	1.60	3.06	1.48	4.04	1.32
170	1.35	3.89	1.56	2.78	1.81	2.23	2.10	1.90	2.44	1.69	2.83	1.54	3.28	1.44	4.41	1.29
180	1.37	3.71	1.60	2.66	1.87	2.14	2.19	1.83	2.57	1.63	3.00	1.49	3.51	1.39	4.81	1.26
190	1.39	3.54	1.64	2.55	1.94	2.06	2.29	1.77	2.70	1.58	3.19	1.45	3.77	1.36	5.25	1.23
200	1.42	3.39	1.69	2.45	2.01	1.99	2.39	1.71	2.85	1.54	3.39	1.41	4.04	1.32	5.73	1.21
210	1.44	3.25	1.73	2.36	2.08	1.92	2.50	1.66	3.00	1.49	3.61	1.38	4.33	1.30	6.25	1.19
220	1.47	3.13	1.78	2.28	2.16	1.86	2.61	1.62	3.16	1.46	3.83	1.35	4.65	1.27	6.81	1.17
230	1.49	3.02	1.83	2.21	2.23	1.81	2.73	1.57	3.34	1.42	4.08	1.32	4.98	1.25	7.44	1.15
240	1.52	2.94	1.87	2.14	2.31	1.76	2.85	1.54	3.51	1.39	4.33	1.30	5.34	1.23	8.12	1.14
250	1.55	2.82	1.92	2.08	2.39	1.71	2.98	1.50	3.70	1.36	4.61	1.27	5.73	1.21	8.86	1.13
260	1.57	2.74	1.98	2.02	2.48	1.67	3.11	1.47	3.90	1.34	4.90	1.25	6.14	1.19	9.67	1.12
270	1.60	2.66	2.03	1.97	2.57	1.63	3.25	1.44	4.11	1.32	5.20	1.23	6.59	1.18	10.55	1.10
280	1.63	2.58	2.08	1.92	2.66	1.60	3.39	1.41	4.33	1.30	5.53	1.22	7.06	1.16	11.51	1.10
290	1.66	2.51	2.14	1.88	2.75	1.57	3.55	1.39	4.57	1.28	5.88	1.20	7.57	1.15	12.56	1.09
300	1.69	2.45	2.19	1.83	2.85	1.54	3.70	1.37	4.81	1.26	6.25	1.19	8.12	1.14	13.71	1.08

MACHINERY'S Data Sheet No. 198, New Series, March, 1931

Compiled from Data Furnished by the Dodge Mfg. Corporation

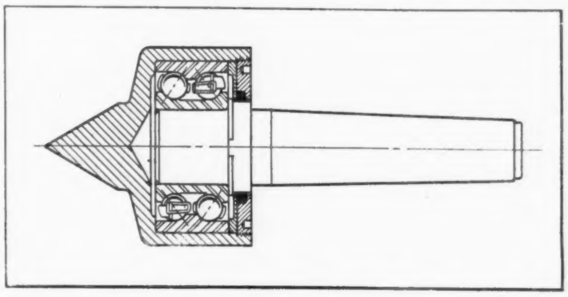
blanks or similar parts having no projections, which must be located centrally and prevented from turning with the tools. The Type S flexible spring-clamping fixtures are also made for work that does not require the solid lock clamping feature of the other types. The line also includes Type LH fixtures, which are intended for heavy-duty work on such parts as exhaust and intake manifolds or for pieces handled in multiple up to six.

HORSBURGH & SCOTT SMALL WORM-GEAR SPEED REDUCER

Worm-gear speed reducers in capacities from 5.4 horsepower down to 0.07 horsepower are being introduced on the market by the Horsburgh & Scott Co., Cleveland, Ohio, in two series known as WB 600 and WB 700. These reducers are designed to permit rotation of the worm in either direction. Although the gear-shaft is made regularly to extend toward the left, it may be extended toward the right or in both directions.

As may be seen from the illustration, which shows both shafts pulled out of the housing, the unit consists essentially of a worm and gear mounted on shafts that run in anti-friction bearings. Gurney radial thrust bearings are supplied for the worm-shaft and Timken tapered roller bearings for the gear-shaft. The mechanism is enclosed in an oil-tight, dustproof housing.

In this speed reducer, the worm is forged integral with its shaft, thus permitting larger diameters to be used and insuring concentricity of the worm and shaft. The worm threads are ground on the top, bottom, and sides after hardening. The worm-gear is made of bronze and has a wide face. Large gear reductions permit the use of high-speed motors.



Red-E Ball-bearing Live Center with New Type of Closure

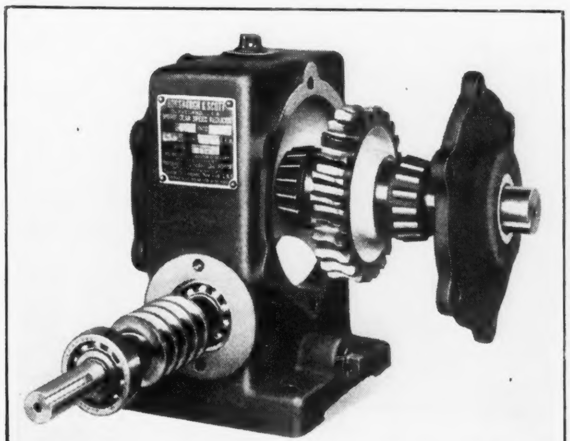
RED-E IMPROVED LIVE CENTERS

The ball-bearing live centers manufactured by the Ready Tool Co., 550 Iranistan Ave., Bridgeport, Conn., are now provided with a new and more efficient bearing closure. This closure consists of two parts, an inner piece or washer which bears directly against the face of the New Departure preloaded double-row ball bearing used, and an outer piece or lock-nut which carries the felt ring. With this arrangement, all threads are on the relatively thick outer piece, and a stronger and more secure clamping effect is obtained. The construction may be seen from the illustration.

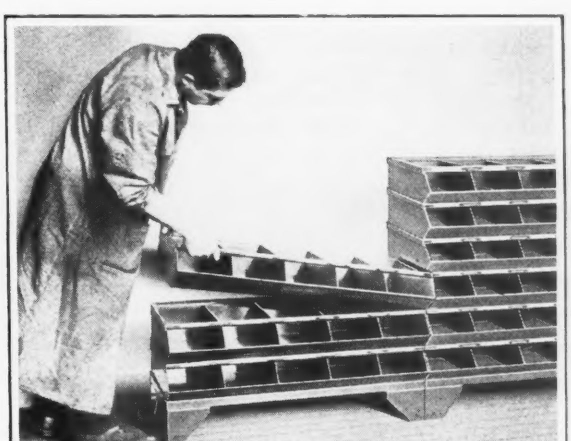
Since permanence of the rigidity and accuracy of the bearing depends upon the exclusion of abrasive dirt from the balls and races, it is desirable that the closure shall not be removed. For this reason, the set-screw that locks the clamp-nut is covered with a soft metal seal.

SIMPLEX BIN SECTIONS

Bin sections designed to be stacked on top of one another in the manner illustrated are being placed on the market in four standard sizes by the Simplex Tool Co., Woonsocket, R. I. As these sections are not bolted together, they can be easily removed or rearranged at any time. Each section nests deeply into the next and is of such width and depth that when several sections are nested together they make a substantial unit.



Horsburgh & Scott Worm-gear Speed Reducer Made in Low Horsepower Ratings



Simplex Bin Sections which can be Conveniently Stacked on Top of One Another

The base is separate from the sections, and a top can be furnished to serve as a counter or as a shelf when small and large sections are assembled together. In such a case, the larger sections are used up to the counter height and the smaller sections above. All four sizes of these sections are 37 inches in width. They range in depth from 12 to 20 inches and in height from 4 to 9 1/2 inches.

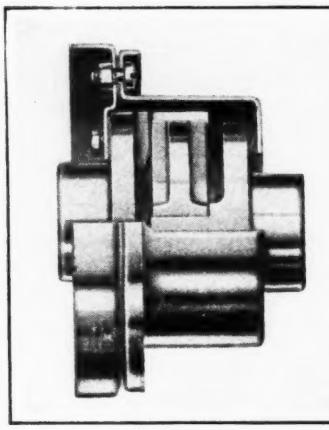
FRANCKE FLEXIBLE COUPLING WITH ENCLOSING GREASE CASE

Smith & Serrell, 62 Washington St., Newark, N. J., have recently brought out a Francke flexible coupling equipped with a pressed-steel enclosing case which serves as a reservoir for grease. This case provides a means of adequately lubricating all moving parts if replenished with lubricant once or twice a year.

The clearance hole at the end of the grease case permits as much as 1/16 inch of axial or out-of-center misalignment. The case also acts as a limit stop, because when the clearance is equal all around the hub. the indication is that the shafts are in alignment. This is a check that can be made without disturbing the coupling or the machine. When it is desired to check the alignment more accurately or to pack the case with grease, the two flanges of the case can be readily separated.

For usual installations, ordinary cup grease is recommended, while for operation under higher temperatures, a somewhat harder grease should be used. The flanges of the grease case are designed to project beyond all bolt heads or nuts.

This coupling embodies two forged-steel flanges and a lightweight center cross-piece, the construction being similar in many respects to the well-known Oldham coupling. It is made in four sizes, the maximum bore ranging from 1 1/8 to 1 7/8 inches. The illustration shows a part sectional view of the coupling with the shafts out of alignment.



Francke Flexible Coupling with Enclosing Case that Serves as a Grease Reservoir

METAL-SLITTING SAW AND END-MILLS

A metal-slitting saw with staggered side teeth, which is adapted particularly for deep slotting operations, is being placed on the market by the Union Twist Drill Co., Athol, Mass. It is shown in Fig. 1. The saw is made in diameters up to 10 inches, and in thicknesses of 3/16 inch and over.

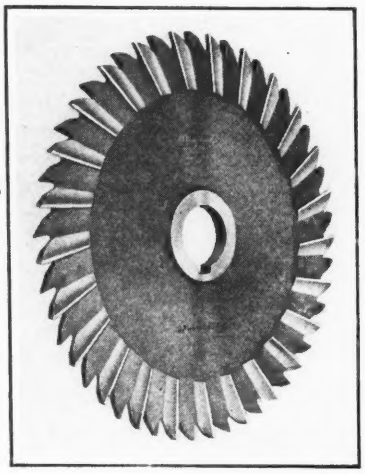


Fig. 1. Slitting Saw with Staggered Side Teeth Made by the Union Twist Drill Co.

The same concern has also recently developed the end-mills shown in Figs. 2 and 3. The two-lipped end-mill in Fig. 2 has a threaded hole in the shank end to receive a draw-in bolt. This is also true of the coarse-tooth end-mill shown in Fig. 3. Both of these tools are made in diameters up to about 1 1/2 inches.

NAUDAIN RAPID-HEATING OIL BURNER

A fuel-oil burner designed to operate exclusively on air at a low pressure of from 10 to 14 ounces per square inch or to operate at a low air pressure at the same time that high air pressure or steam is employed for atomizing has been placed on the market by the Naudain Mfg. Co., 1001 Rectory Lane, Baltimore, Md. This burner is intended for application to heating, welding, forging, and melting furnaces.

The burner body is machined to suit a reversible air valve, an adjusting cone bushing, and a removable inner tube which contains a needle valve, oil-tube, mixer, and atomizer cap. The unit is mounted on a bracket which is bolted to the forge or furnace. The burner is held in

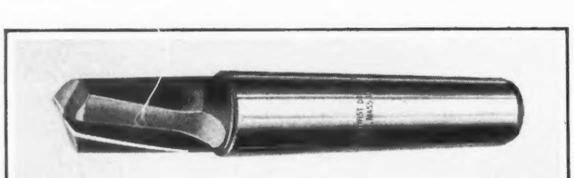


Fig. 2. Two-lipped End-mill with Threaded Hole in Shank for a Draw-in Bolt

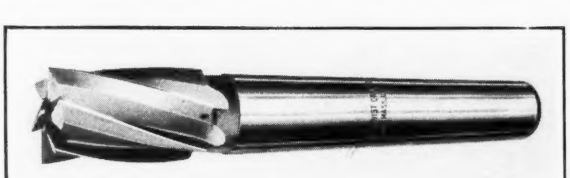
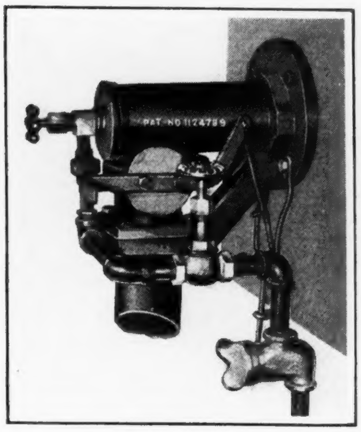


Fig. 3. Coarse-tooth End-mill which also has a Threaded Hole in the Shank End



Naudain Oil Burner Made in 3- and 4-inch Sizes

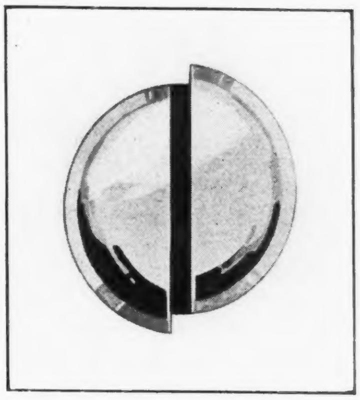
alignment with the flue and may be removed without dismantling the large air pipe or other parts. A plate protects the burner from the intense heat while it is inactive. This plate is automatically opened and closed by means of the air-valve handle. The burner is self-cleaning and does not carburize.

HOPKINS AIR-OPERATED MILLING MACHINE VISE

An air-operated, milling machine vise of such construction that milling cutters can pass completely over it is being placed on the market by the Tomkins-Johnson Co., Jackson, Mich. The hardened jaws with which the vise is regularly equipped can be removed to permit the insertion of jaws especially suited to the work. Slots provide for readily clamping the vise to the machine table, and there are keys fastened in the base to suit the slots of milling machine tables and thereby insure proper alignment. The important dimensions of the vise are as follows: Width of jaws, 6 1/4 inches; height of jaws, 1 11/16 inches; maximum distance between jaws, 4 inches; length of base, 24 5/8 inches; width of base, 7 inches; and power stroke of movable jaw, 1/8 inch.

SHAKEPROOF SELF-LOCKING SET-SCREW

Set-screws so designed as to be self-locking are being introduced on the market by the Shakeproof Lock Washer Co., 2501 N. Keeler Ave., Chicago, Ill. As may be seen from the illustration, which shows an enlarged top view of a set-screw,



Enlarged Top View of Shakeproof Self-locking Set-screw

the slotted end is offset. As the screw is driven home, the sharp edges "bite" into the work in such a way as to resist any backward movement of the screw.

FEDERAL CYLINDER TEST GAGE

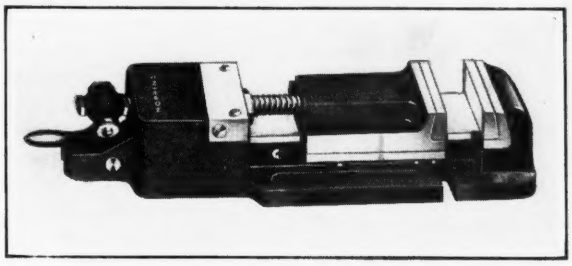
The gage here illustrated provides a quick and accurate means of measuring small holes while the work is in a grinding machine, lathe, or automatic screw machine. It may also be equipped with an attachment for mounting permanently on a bench. Inside diameters of from 1/4 to 1 1/2 inches can be checked by the use of gaging plugs that range in length from 2 3/4 to 5 1/4 inches. These plugs have a two-point contact and check holes for size, out-of-roundness, taper, and bell-mouth to within less than 0.0001 inch. The plugs can be removed and others substituted in thirty seconds.

This gage is a recent addition to the line of precision measuring instruments that is manufactured by the Federal Products Corporation, 1144 Eddy St., Providence, R. I.

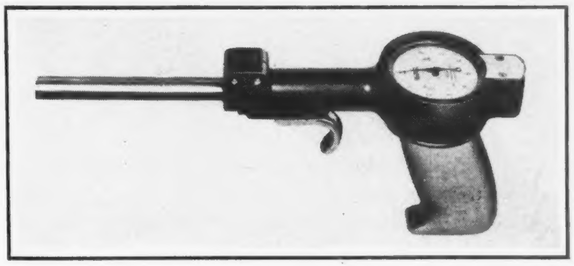
MASTER GEARED-HEAD MOTORS

Geared-head motors are being made by the Master Electric Co., Dayton, Ohio, in two styles; in one, the slow-speed shaft is parallel with the motor shaft, while in the other, it is at right angles to the motor shaft. The latter style is shown in the illustration. It is manufactured in various capacities from 1/30 to 5 horsepower for single-phase and direct current, and from 1/30 to 10 horsepower for polyphase alternating current. Standard ratios range from 8 to 1 up to 72 to 1.

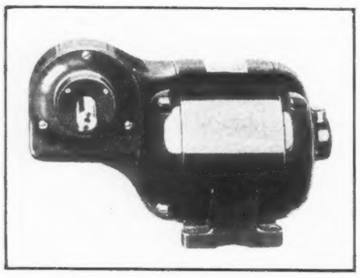
The parallel-shaft type is also made in sizes from 1/30 to 5 horsepower for single-phase and direct current, but for polyphase alternating current, the sizes range from 1/30 to 20 horsepower. This type is made in various reductions up to a maximum of 6 to 1 and with a maximum acceleration of the motor



Hopkins Air-operated Milling Machine Vise



Federal Gage for Checking Small Holes



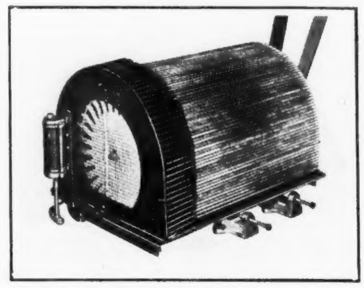
Motor with Slow-speed Shaft at Right Angles to Motor Shaft

speed of 2.5 to 1. Both types of motors are provided with ball bearings on the motor shaft and roller bearings on the slow-speed shaft.

The same concern has also brought out a line of small motors in which the switch is an integral part. These motors are designed primarily for use in hazardous vapors, and range in size from 1/2 to 1/3 horsepower. The design eliminates the wiring, piping, splicing, etc., required with the usual installation in which a separate switch is employed.

ENCLOSURE FOR OPEN-FRAME MOTORS

An enclosure designed to protect open-frame electric motors from an accumulation of dirt, dust, and moisture is a recent development of the Daun-Walter Co., 508 N. Water St., Milwaukee, Wis. As shown in the illustration, this enclosure consists essentially of a corrugated copper cover with steel end walls and a baseplate. At one end there is a cooling fan and an outside combination guard and air deflector. By means of the fan and air deflector, outside air is discharged over the outer areas of a patented deep-fin corrugated copper construction that encloses the motor, thereby carrying off the heat developed by the motor. This enclosure is available for all open-frame type motors of from 5 to 100 horsepower.



Enclosure Made by the Daun-Walter Co. for Motors

ROCKWOOD SHORT-CENTER BELT DRIVES

Short-center flat belt drives are being manufactured in a wide range of standard sizes by the Rockwood Mfg. Co., Indianapolis, Ind. Based on a speed of 1800 revolutions per minute, these drives have capacities of from 1 to 50 horsepower. Because of the means employed for uniformly maintaining the belt tension, the drives may be used in installations where the pulleys almost touch each other.

From Figs. 1 and 2, it will be seen that these drive units consist of Rockwood pulleys, a flat leather belt, and an electric motor mounted on a Rockwood pivoted bracket. This bracket is made to suit the recently standardized motor bases, and can be used in combination with any make of motor. The bracket can be conveniently mounted in various positions on the floor, wall, or ceiling, with the motor arms extending either horizontally or vertically.

The weight of the motor places a sufficient tension on the drive belt to insure efficient power transmission without slippage, and keeps this tension uniform regardless of any stretch that may develop in the belt.

A data book prepared by the concern lists the combination of pulley sizes that will give any desired speed of the driver shaft for any given motor speed and power. To make these short-center drives available quickly throughout the country, they are stocked in forty warehouses that serve as distribution points for belting manufacturers and electrical supply houses.

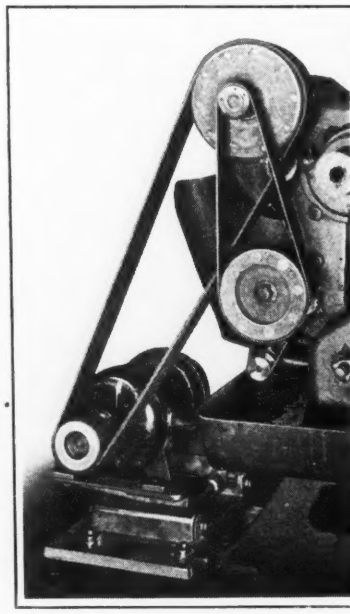


Fig. 2. Short-center Drive with Base-floor Mounting, Installed on a Turret Lathe

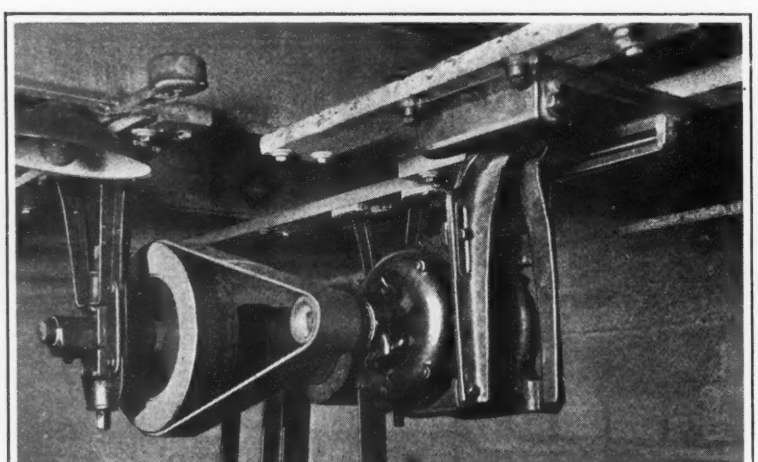
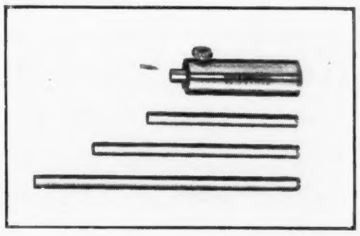


Fig. 1. Ceiling Installation of Rockwood Short-center Drive with a Center Distance of 24 Inches



Small Brown & Sharpe Depth Gage and Measuring Rods

BROWN & SHARPE SMALL DEPTH GAGE

A small depth gage designated as the No. 599 has been brought out by the Brown & Sharpe Mfg. Co., Providence, R. I., for accurately checking the depth of holes and counterbores, distances between shoulders and flanges, etc. An important advantage of this gage is that it can be used against or between small shoulders or in shallow recesses.

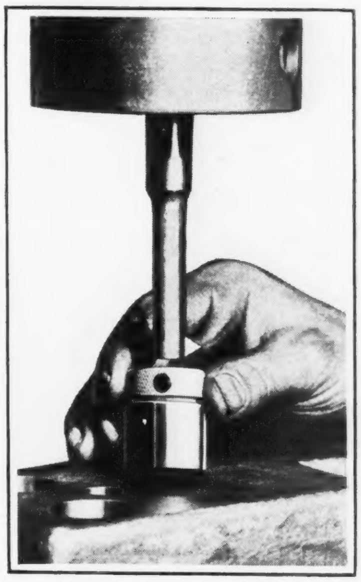
Depths from 0 to 2 inches can be determined in thousandths of an inch by measuring the over-all length of the body and rod by means of a micrometer and then subtracting the length of the body, which is exactly 1 inch. The body is provided with a V-groove, which facilitates measuring against curved surfaces. Settings of the rod can be securely locked by means of the clamp-screw.

If desired, the gage can be used for measuring distances from 1 to 3 inches between shoulders, etc. When used for such purposes, a micrometer reading of the over-all tool length is, of course, the desired dimension.

PRATT & WHITNEY STUB GAGES

Stub gages have been placed on the market by the Pratt & Whitney Co., Hartford, Conn., for use in precision boring or similar operations when the clearance between the tool and the hole is short and makes inspection difficult. They enable convenient inspection of bored holes with the boring head clamped in position close to the work.

The illustration shows one of these gages being used in a typical manner. The gages are made with the usual cylindrical gaging surface, but a short knurled finger grip is substituted for the handle. The larger sizes are hollow to give lightness, and a hole through the finger grip permits the insertion of a pin when necessary. The gaging surface is machine-lapped to size. The gages are available either singly or in a set of seventeen

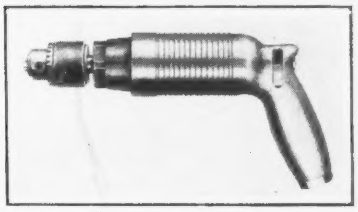


Using the Pratt & Whitney Stub Gage to Check a Bored Hole

sizes, which come in a wooden case. The sizes range from 1/8 to 2 inches.

CHICAGO PNEUMATIC "MIDGET" ROTARY DRILL

A 1/4-inch pneumatic drill which weighs only 3 1/2 pounds has been added to the line of portable tools manufactured by the Chicago Pneumatic Tool Co.,



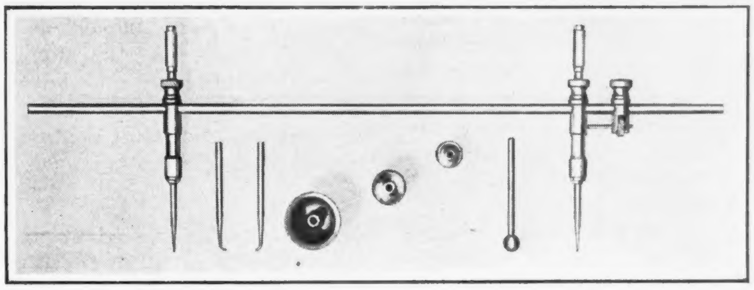
Chicago Pneumatic Air Drill of Light Weight

6 E. 44th St., New York City. This tool is particularly adapted for the construction of airplanes, metal casements, metal furniture, etc. The throttle parts are rustproof. The drill has a "light" speed of 2500 revolutions per minute, and an over-all length of 9 1/8 inches.

STARRETT STEEL TRAMMELS

Trammels incorporating a number of improvements over the older types have been placed on the market by the L. S. Starrett Co., Athol, Mass. These trammels, which are designated as No. 251, have a beam made of a steel rod which is stiff enough to prevent bending. The beam is flattened on top, so that after the trams have been clamped in position, they will not turn when pressure is applied to the points.

As the illustration shows, one of the trams is equipped with an adjusting screw, which facilitates fine settings. Positioning of the points is made easy by means of spring devices, which hold the trams in place when the nuts are loosened. The knurled grips make the trammels easier to use and tend toward greater accuracy. They are in the form of rollers, which turn freely with the fingers as an arc is scribed.

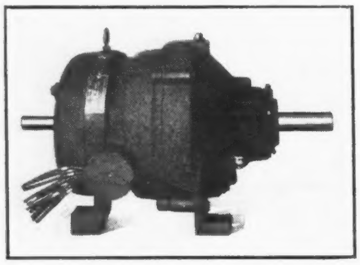


Starrett Improved Trammels with Steel-rod Beam

The trammel points are adjustable in their spring chucks and can be easily replaced by pencils, caliper legs, or ball points. The ball points permit working from holes up to 1 1/2 inches in diameter. Beams of various lengths can be supplied for scribing circles up to 18, 26, and 36 inches in diameter. In addition, an extra 20-inch beam with a rigid coupling can be supplied when it is desired to increase the range to circles as large as 72 inches in diameter.

TWO-SPEED MOTORIZED SPEED REDUCERS

Motorized speed reducers with shafts extending at both ends are now manufactured by the Production Equipment Co., 5219 Windsor Ave., Cleveland, Ohio.



Two-speed Reduction Unit Made by the Production Equipment Co.

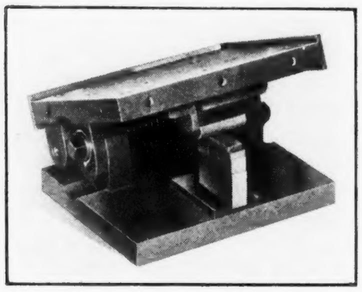
These speed reducers consist of standard or special polyphase induction motors equipped with spur, helical, planetary, or bevel gears contained in an oil-tight housing.

The low-speed shaft may be run at a speed as low as 20 revolutions per minute or as high as 875 revolutions per minute. The opposite shaft, driven direct from the motor, provides a high speed of 720, 900, 1200, or 1800 revolutions per minute. For certain applications, speed reducer units can be supplied at both ends to give the same or different speeds.

KRAG SINE-ANGLE PLATE

A sine plate consisting of two blocks or plates hinged together so that one can be clamped at any angle between 0 and 45 degrees with respect to the other, is being introduced to the trade by Franz K. Krag, 319 N. Albany Ave., Chicago, Ill. As will be seen from the illustration, the bottom plate or base is provided with an accurately ground, hardened and lapped anvil, and the upper plate is equipped with a ground, hardened and lapped cylinder. Precision gage-blocks are placed between the anvils and the cylinder, as shown, to incline the upper plate to any desired angle. It is claimed that when precision gage-blocks are used, the top plate can be set to any angle within an accuracy of 0.0001 inch in a length of 3 inches. Clamping screws are used to lock the plate in any required setting.

To find the equivalent angle after a setting has been made, the space between the anvil and cylinder is measured with the precision gage-blocks and the dimension is compared with a sine table furnished. The sine plate is available in two models, a Model S, which is made of hardened steel throughout, and a Model C, which is made of cast iron, except for the shaft and bushings. The base and top plate each measure 4 15/16 by 4 inches and are 1/2 inch thick.



Krag Sine-angle Plate Set to Any Angle by Means of Precision Blocks

TIME REQUIRED FOR HOBBING GEARS

By U. SETH EBERHARDT
Works Manager, Newark Gear Cutting Machine Co., Inc.

In the article "Estimating Time Required for Hobbing Gears," published on page 421 of February MACHINERY, the author has not taken into account the fact that hobs are swiveled an amount equal to their end angle, thus materially changing the time before the hob is cutting to full depth (dimension *A* in the diagram, page 421) and also the time necessary for the hob to finish the cut.

A hob of 4-inch outside diameter, 6 diametral pitch, single-threaded, has an end angle of 2 degrees 36 minutes. For cutting a gear having 36 teeth, it would be necessary to add about 1/8 inch to the complete travel of the hob.

A double-threaded hob of the same diameter and pitch has an end angle of 5 degrees 12 minutes, requiring about 1/4 inch extra movement. A triple-threaded hob of the same diameter and pitch would have an end angle of 7 degrees 46 minutes, requiring an extra movement of about 3/8 inch. As the number of teeth in the gear to be cut increases, the time necessary for the hob to cut to full depth increases also.

* * *

Much time is wasted by aiming at the ideal in standardization work; the aim should be that which is practical.

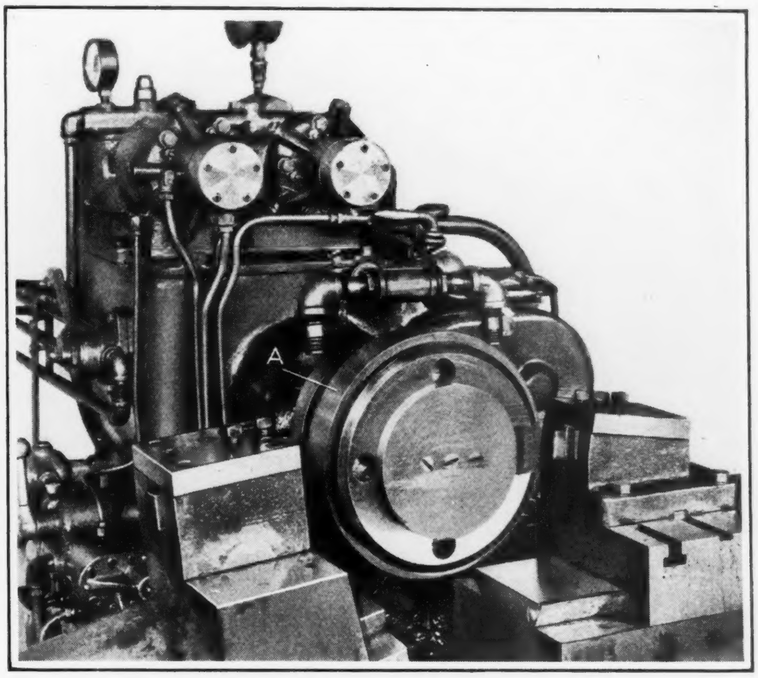
INDUSTRIAL MACHINERY EXPORTS IN 1930

Complete statistics are now available covering the industrial machinery exports from the United States in 1930. According to *Commerce Reports*, the total for industrial machinery of all kinds amounted to $227,000,000. Of this, metal-working machinery accounted for $42,000,000, an increase of $1,200,000 over 1929. There has been a great increase in the exports of metal-working machinery during the last few years. In 1926, the exports were valued at $19,000,000, rising in 1927 to $25,000,000, in 1928 to $34,000,000, in 1929 to $40,800,000, and in 1930 to $42,000,000, as mentioned. Next to Canada, Europe is the best customer of the United States.

Machining Alloy Steel Forgings at High Speed

Tungsten-carbide tools and hydraulic feeding have proved a very effective combination for turning, facing, and chamfering some exceptionally tough, ring-shaped forgings employed for bearing cups. Although these forgings are made from 4 per cent nickel and 1 1/2 per cent chromium steel, which has a tensile strength of 200,000 pounds after annealing, the outside is turned to size within limits of plus or minus 0.0015 inch in one cut. Approximately 1/8 inch of stock is removed at a surface speed of 340 feet per minute and a feed of 0.030 inch per revolution. This is accomplished on a production basis with tungsten-carbide tools on a Barnes automatic lathe equipped with multi-range hydraulic feed, as built by the John S. Barnes Corporation, Rockford, Ill. The facing and chamfering of the ring-shaped forging also requires only a single cut over each of the surfaces.

The hydraulic feed is of the closed circuit type designed to eliminate backlash and to provide a feeding movement which maintains a uniform pressure between the cutting tools and the work throughout the cut. The success of the tungsten-carbide tools in machining this work is attributed in a large measure to the rigidity of the work-supporting spindle, the smooth feed, and the fact that the tools have practically no overhang. At the speed and feed employed, the job is completed so quickly that there is practically no heating of the work and the finish has the appearance of a ground surface. By the use of tungsten-carbide tools, it is possible to maintain the size accurately for a long period, and the machine can be kept running almost continuously.



Automatic Lathe with Hydraulic Feed and Tungsten-carbide Tools Set up for Machining the Ring-shaped Forging A

* * *

An association known as the American Machinery and Tools Institute has been organized, with headquarters at 40 N. Wells St., Chicago, Ill. W. R. Mau of the Vanadium-Alloys Steel Co. is president, and George R. Tuthill, executive secretary. The purpose of the Institute is to promote the interests of those engaged in the design, manufacture, or sale of machinery or tools. Everyone engaged in this kind of work is eligible for membership. Meetings will be held in local centers to discuss important topics pertaining to the machinery and tool industry. The Institute will interest itself in trade education, research, public relations, advertising, publicity, merchandising, accounting, credit service, and legal questions of importance to members.

What Industry Expects from the Engineering School

In a paper dealing with what industry expects from the engineering school, F. A. Merrick, president of the Westinghouse Electric & Mfg. Co., recently pointed out that in many manufacturing industries, especially in the electrical field, it is almost essential that the commercial man should have an engineering training. It has been found advantageous in an increasing degree that not only manufacturing, but also operating, administrative, and executive positions should be filled by men having a background of technical training.

Mr. Merrick also emphasized the fact that broad-visioned industrial executives do not expect the engineering schools to furnish a finished engineer to industry. The engineering school has performed its function properly if it has carefully selected the student for training, has helped him to develop his intellectual capacity, and has instilled him with a desire to go further than any school can take him. In other words, the engineering school should familiarize the undergraduate with the kind of work done in industry, imbue him with regular habits of work, and make him realize that when he receives his diploma, it is merely equivalent to his entrance certificate in the school of industrial life, where he will work out his own results with the aid of the fundamentals that he has absorbed in his previous training.

What industry wants from the engineering school is men who can and will do some one thing better than it has ever been done before; who have the capacity, after having been duly trained in the industry, to add something to the sum of human experience. The technical man, properly qualified by training, willing to work, and with a personality that permits him to achieve results by cooperating with others, has greater opportunities in industry today than ever before.

* * *

The General Electric Co. has awarded thirty-eight employes of the company certificates and money awards for ideas that have resulted in valuable contributions to the progress and efficiency of the company. Seven of the recipients are shop workers; five are foremen; six are tool designers; eleven are engineers; six are commercial men; and three administrative employes. Since the establishment of the Charles A. Coffin Foundation in 1922, under the auspices of which these awards are made, 279 awards have been received by the employes.

NEWS OF THE INDUSTRY

Ogden R. Adams, Rochester, N. Y., moved his office on March 1 from 407 Cutler Bldg. to 316 Broad St., corner of Oak, where he will have facilities for the storage and display of machinery.

Duriron Co., Inc., Dayton, Ohio, has opened a branch office in the General Motors Bldg., Detroit, Mich. Richard R. Rourke, former sales engineer of the company, has been appointed manager.

Fellows Gear Shaper Co., Springfield, Vt., announces that after March 1 the headquarters of W. F. Slomer, general sales and service manager of the company, will be located at 616 Fisher Bldg., Detroit, Mich.

Watson-Stillman Co., 73 West St., New York City, manufacturer of hydraulic machinery, has appointed the Moorlane Co., Tulsa, Okla., exclusive representative of the company in the state of Oklahoma.

Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., held its annual sales convention in Detroit, February 5 to 7, which was attended by thirty executives and salesmen from the different branch offices.

Geometric Tool Co., New Haven, Conn., has appointed the J. H. Ryder Machinery Co., Terminal Warehouse Bldg., Foot of York St., Toronto, Ont., Canada, agent for the sale and servicing of Geometric products in the Province of Ontario.

N. A. Strand & Co., 5001-5009 N. Lincoln St., Chicago, Ill., manufacturer of flexible shafts, has appointed the Star Machinery Co., 1731-1741 First Ave., S., Seattle, Wash., exclusive distributor for the company in the state of Washington.

Dardelet Threadlock Corporation, 120 Broadway, New York City, announces that licenses to manufacture the Dardelet self-locking screw thread have been granted to W. L. Brubaker & Bros. Co., Millersburg, Pa., and to William H. Ottemiller Co., York, Pa.

Whitney Metal Tool Co., Rockford, Ill., has added to its line of manufactured products two hand dollies, one intended for sheet-metal shop use, and the other, which fits into the tool-box, for outside work. These appliances are drop-forged, and have machined and hardened surfaces.

R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, announces that a deferred payment plan has been worked out for the sale of the Regal lathes recently placed on the market by the company in sizes of from 10- to 18-inch swing. The distribution is through dealers on an exclusive territory basis.

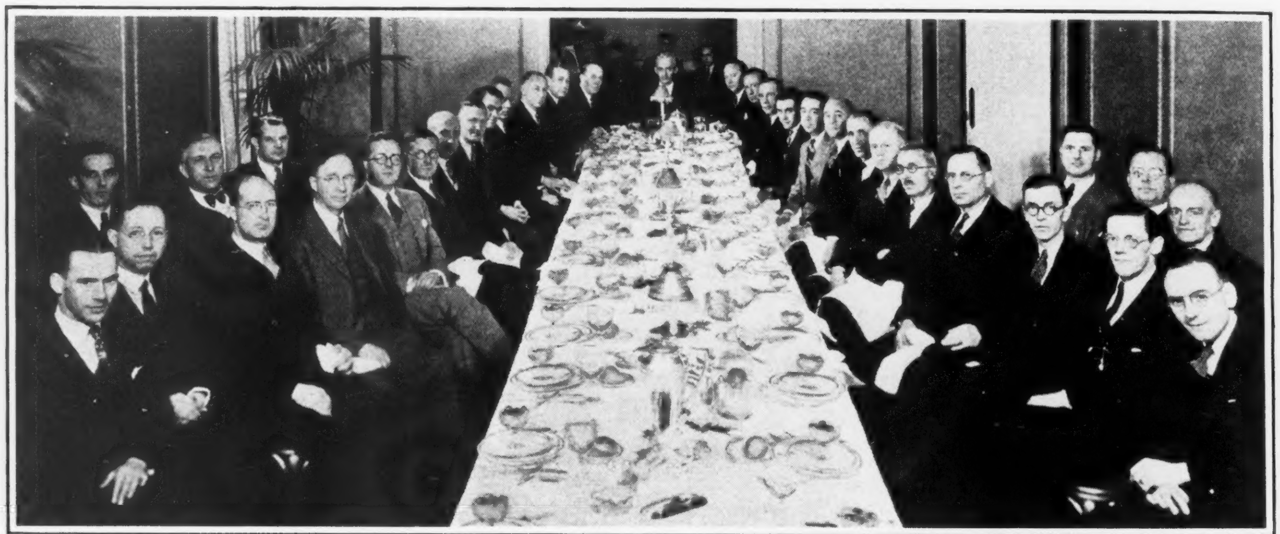
Western Machine Tool Works, Holland, Mich., announces the purchase of the complete business of the Chard Lathe Co., Newcastle, Ind., manufacturer of Chard lathes. The Western Machine Tool Works will continue to manufacture this line of lathes, ranging in size from 16 to 28 inches, at its plant in Holland, Mich.

American Engineering Co., 2435 Aramingo Ave., Philadelphia, Pa., has appointed Le Sauvage & Beardsley, Genesee Bldg., Buffalo, N. Y., direct representatives for Lo-Hed monorail electric hoists in the districts of Buffalo and Rochester. Weed & Co. will continue to distribute Lo-Hed hoists in that district, cooperating with Le Sauvage & Beardsley.

Illinois Testing Laboratories, Inc., 141 W. Austin Ave., Chicago, Ill., have appointed Porter Hurd, 516 Packard Bldg., Philadelphia, Pa., representative of the company in eastern Pennsylvania, southern New Jersey, Delaware, and Maryland for the sale of portable and stationary indicating pyrometers, resistance thermometers, and other measuring instruments for industrial purposes.

Morse Chain Co., Ithaca, N. Y., manufacturer of silent chain drives, flexible couplings, and chain speed reducers, held its annual sales convention about the middle of February. At that time, the company's salesmen from the entire United States spent three days at the plant in Ithaca, leaving by special car for a one-day session at Detroit. Officials of the Borg-Warner Corporation, of which the Morse Chain Co. is a subsidiary, were also in attendance.

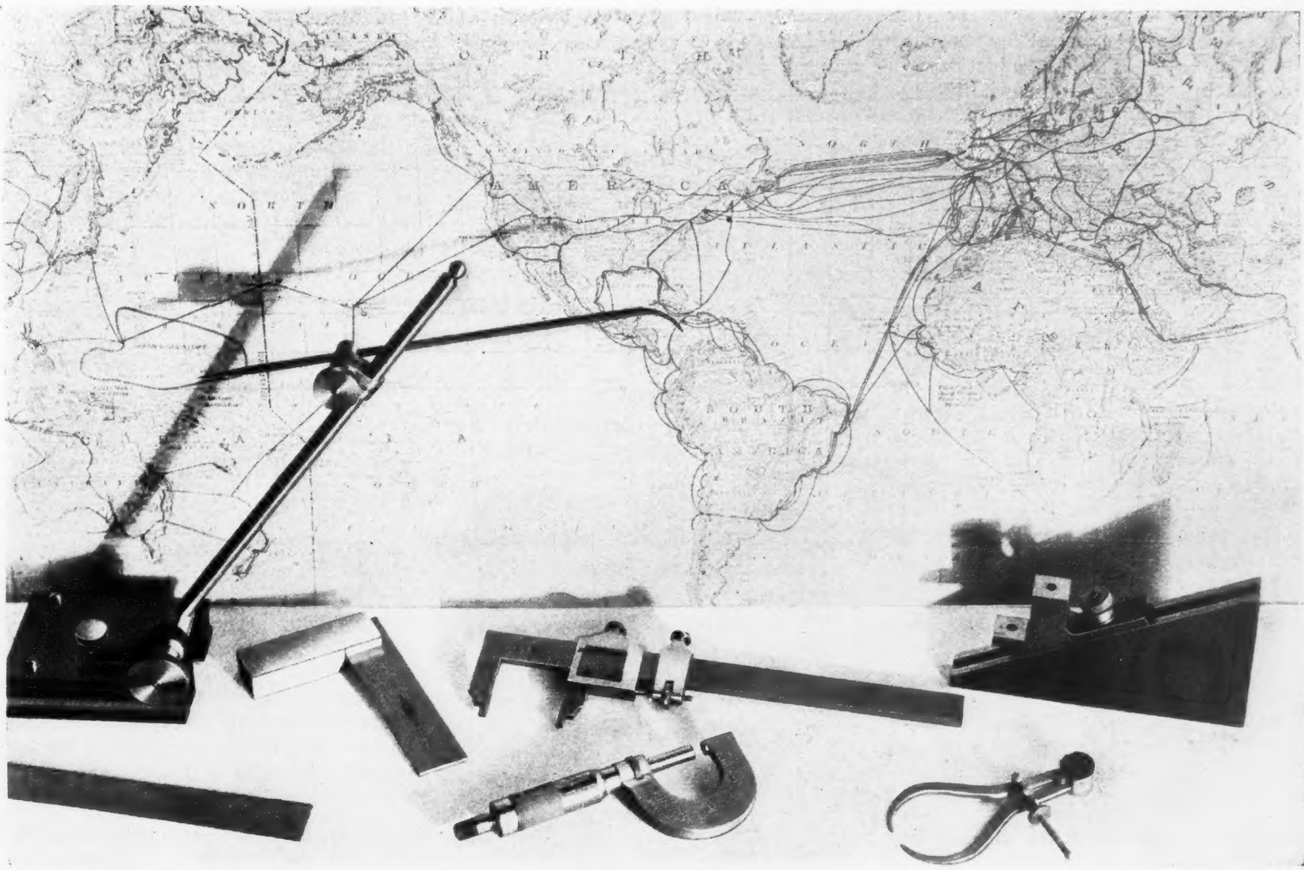
C. F. Laganke Co., Inc., Cleveland, Ohio, has removed its factory from 118 St. Clair Ave., N.E., to 6545 Carnegie Ave., Cleveland. The new quarters afford more than double the floor space of the old ones, and provide room for further expansion. New equipment has been added, so that in addition to its regular line of jigs, fixtures, gages, and dies, the company is now in a position to manufacture special machinery of small and medium size.



Final Event in the Three Days' Sales Convention of the Morse Chain Co. Recently Held at Ithaca, N. Y.

Geometric Tool Co., New Haven, Conn., manufacturer of screw-cutting machines and tools, has appointed C. W. Marwedel, 76 First St., San Francisco, Cal., exclusive agent for the company in Northern California. The Tool Equipment Co., formerly exclusive agent for the Geometric Tool Co. in the Pacific and Rocky Mountain states, will continue to handle the sale and servicing of Geometric products in Southern California.

Worthington Pump and Machinery Corporation, 2 Park Ave., New York City, held its annual meeting of sales executives from all over the United States in Harrison, N. J., February 9 to 11. At the meeting, H. C. Beaver, formerly executive vice-president of Rolls-Royce of America, was introduced as a new vice-president. He will devote his efforts principally to the administration of the sales department. E. E. Yake was advanced to vice-president in charge of manufacturing and engineering.



JOSEPH T. RYERSON & SON, INC., Chicago, Ill., have acquired by purchase the lines of Maximillers, production milling machines, and automatic indexing machines made by the Kempsmith Mfg. Co., Milwaukee, Wis. The purchase includes good will, patents, patterns, inventory, and other assets pertaining to these lines. The cone drive milling machines made by the Kempsmith Mfg. Co. are not included in the transaction. The Sidney Machine Tool Co., Sidney, Ohio, will build the former Kempsmith products for the Ryerson concern. The company will also continue to manufacture its present line of Monotrol and Tritrol types of lathes. H. L. Livesay, formerly factory manager of the Kempsmith Mfg. Co., will be in charge of the production of milling machines at the Sidney plant. The Ryerson concern will act as general distributor of the Kempsmith milling machine line, direct the sales policy, and furnish engineering service to the trade.

PERSONALS

GRANT FOLIN, who has been associated with the Union Twist Drill Co., Athol, Mass., for the last six years, has been made sales manager.

RALPH WEDDELL, who for the last two years has been chief engineer of the O. K. Tool Co., Inc., Shelton, Conn., has been made sales manager of the company.

R. M. CHESTER has been appointed general sales manager of the Neely Nut & Bolt Co., Pittsburgh, Pa. He will make his headquarters at the general offices of the company in Pittsburgh.

W. H. WORRILOW, of the Lebanon Steel Foundry, Lebanon, Pa., was elected president of the Steel Founders' Society of America, Inc., at the recent annual meeting of the Society held at Cleveland, Ohio.

J. B. JOHNSON, chief of the Materiel Branch of the War Department at the Wright Field, Dayton, Ohio, was awarded the Morehead Medal of the International Acetylene Association at the recent annual meeting of the organization.

CLAUS GREVE has been elected chairman of the board of the Cleveland Pneumatic Tool Co., Cleveland, Ohio. L. W. GREVE has been elected president, and JOHN DEMOOY treasurer of the company. Claus Greve, who founded the company in 1899, has been its president up to the present time.

ROBERT LEE WILSON, assistant to the president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has resigned, after thirty-seven years' connection with the company. While Mr. WILSON will devote himself mainly to his private affairs, he will be retained by the company in a consulting capacity.

AUGUSTUS WOOD, formerly chief engineer and works manager of the Niles Tool Works, Co., Hamilton, Ohio, has returned to the company in the capacity of consulting engineer. Mr. Wood is a graduate of Cornell University. He started his engineering career with the Bement-Miles Co., Philadelphia, Pa. When this company became a subsidiary of the Niles-Bement-Pond Co., he was transferred to the Niles Tool Works Co., becoming chief engineer and works manager in 1915, in which capacity he served until 1920. Since that time he has held positions as works manager of the Putnam Machine Co., Fitchburg, Mass., and consulting engineer of Manning, Maxwell & Moore. More recently he has been connected as consulting engineer with the Consolidated Machine Tool Corporation, Rochester, N. Y.

Augustus Wood

H. B. VILLIERS has been appointed head of the recently created department of natural cork isolation of L. Mundet & Son, Inc., 461 Eighth Ave., New York City. The concern manufactures cork board and cork pipe covering, and specializes in the application of natural cork to foundation problems for eliminating vibration and the noise accompanying it.

THOMAS W. PANGBORN, president of the Pangborn Corporation, Hagerstown, Md., manufacturer of sand-blast and dust-collecting equipment, has recently been elected a member of the board of directors of the Equitable Trust Co., Baltimore, Md. Mr. Pangborn is also a director in the Maryland-Virginia Joint Stock Land Bank of Baltimore and the Hagerstown Bank & Trust Co.

J. M. MCNEAL, European sales manager of the Landis Machine Co., Waynesboro, Pa., sailed February 14 for England, after a three weeks' visit to the home office. Mr. McNeal's headquarters are at Birmingham, England, but he supervises the sale of Landis threading equipment both in Great Britain and Continental Europe. Mr. McNeal has associated with him a Landis specialist, D. F. McLaughlin.

PHIL HUBER has been made vice-president and assistant general manager of the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich. When the company was organized in 1919, Mr. Huber was one of the members that formed the original company. Since 1929 he has been factory manager. In the past Mr. Huber has been employed by the Smith & Mills Co., Cincinnati, Ohio, and several other well-known machinery builders. He has also served in various capacities with the Ford, Packard, and Dodge motor car companies.

R. B. MCCOLL has been elected president and director of the McIntosh & Seymour Corporation, Auburn, N. Y., to succeed A. E. BALLIN who has retired. Mr. McColl was born in Scotland in 1882, and has been employed in leading locomotive plants in Great Britain and the United States for many years. In 1922, he became assistant manager of the Schenectady plant of the American Locomotive Co., and in 1925, was made manager of the plant, which position he held until his election as president of the McIntosh & Seymour Corporation.

COMING EVENTS

APRIL 13-18—Second National Industrial Equipment Exposition at the Public Auditorium in Cleveland, Ohio. Managing director, G. E. Pfisterer, 308 W. Washington St., Chicago, Ill.

APRIL 13-18—Eighth annual convention and exhibition of the American Oil Burner Association to be held in Philadelphia, Pa. Harry F. Tapp, executive secretary, 342 Madison Ave., New York City.

APRIL 20-23—Spring meeting of the American Society of Mechanical Engineers at Birmingham, Ala. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 4-9—Annual meeting of the American Foundrymen's Association, to be held at the Stevens Hotel, Chicago, Ill. In conjunction with the meeting, a limited exhibition of foundry equipment and supplies will be held. The office of the executive secretary is 222 W. Adams St., Chicago, Ill.

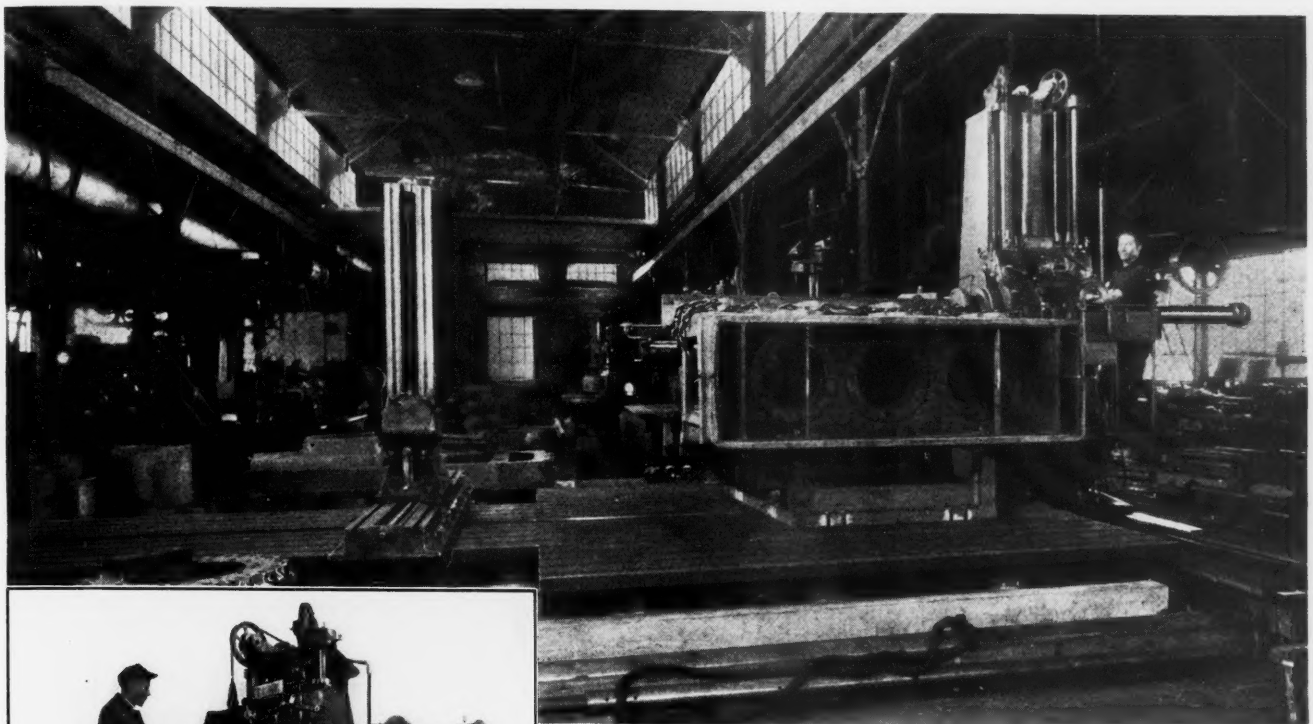
MAY 7-9—Fifteenth annual meeting of the American Gear Manufacturers' Association at the Hotel Statler, Buffalo, N. Y. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

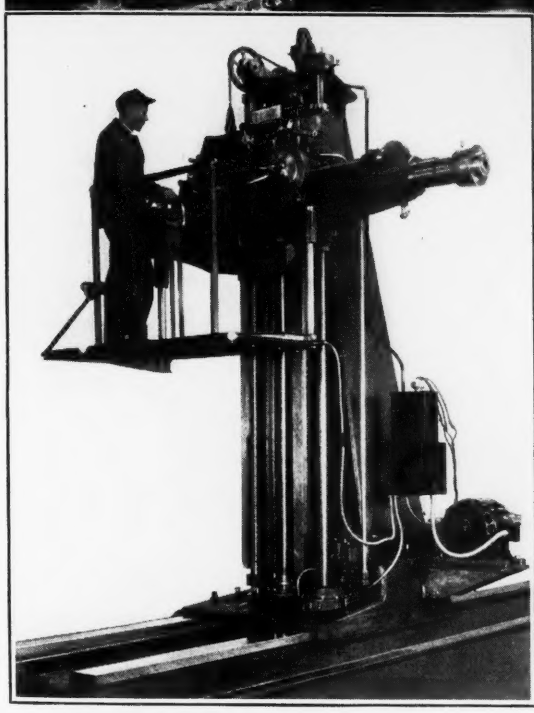
MAY 27-29—Annual convention of the National Foreign Trade Council to be held at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York City.

JUNE 1-3—Regional meeting of the American Society of Mechanical Engineers at Hartford, Conn. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 5-6—Annual convention of the National Association of Foremen at Dayton, Ohio. E. H. Tingley, secretary, U. B. Building, Dayton, Ohio.

OHIO HORIZONTAL BORING, DRILLING AND MILLING MACHINES OHIO





A Big Machine—Showing Big Savings

This large floor type Ohio Horizontal Boring Mill with its extensive floor plate has cut more than 40% off the time required on the job shown above. The Buckeye Machine Co. of Lima, O., is more than pleased with results but expects to show even greater savings when the operator becomes more familiar with the work.

Complete control of the machine is centralized on the operator's platform. The wide range of travel, both vertically and horizontally, permits work over a very large area. And it has the capacity for handling most any job that comes in the shop.

Would you like to have complete data, including time savings on typical jobs handled by Ohio Horizontals? We will be glad to send it.

JOSEPH T. RYERSON & SON, INC.
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FINE MACHINE TOOLS
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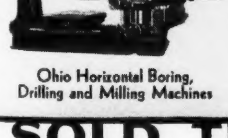
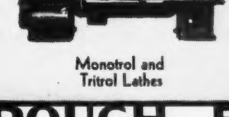


Ohio Horizontal Boring, Drilling and Milling Machines



Monotrol and Tritrol Lathes

Ohio Shapers and Planers

Maximillers
Formerly built by Kempsmith

Dreses Radials

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JUNE 22-26—Annual meeting of the American Society for Testing Materials at the Stevens Hotel, Chicago, Ill. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

SEPTEMBER 21-25—Annual meeting of the American Society for Steel Treating and National Metal Exposition to be held at the Commonwealth Pier, Boston, Mass. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

NEW BOOKS AND PUBLICATIONS

A REPORT OF FOREMANSHIP CONFERENCES. By G. F. Buxton. Published by Purdue University, Lafayette, Ind., as Bulletin No. 25 of the Engineering Extension Department.

ABSTRACTS OF ARTICLES ON FATIGUE OF METALS UNDER REPEATED STRESS APPEARING IN THE TECHNICAL PRESS FROM JULY 1, 1929 TO JUNE 30, 1930. 31 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa.

INDUSTRIAL RESEARCH LABORATORIES OF THE UNITED STATES. Compiled by Clarence J. West and Callie Hull. 267 pages, 6 3/4 by 9 3/4 inches. Published by the National Research Council of the National Academy of Sciences, Washington, D. C. Price, $2.

THE EFFECT OF FURNACE GASES ON THE QUALITY OF ENAMELS FOR SHEET STEEL. By Andrew I. Andrews and Emanuel A. Hertzell. 32 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 214 of the Engineering Experiment Station. Price, 20 cents.

EMPLOYE MAGAZINES. 24 pages, 8 by 10 3/4 inches. Published by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York City.

This report on employe magazines presents the results of a study of the principles and practices involved in the successful conduct of house organs. It is designed to be of assistance not only to those organizations that are considering the establishment of an employe publication, but also to those already engaged in activities of this kind who may be interested in the experience of others. The report was based on a study of more than two hundred different publications.

NOTE ON THE ELECTRICAL RESISTANCE OF CONTACTS BETWEEN NUTS AND BOLTS. By Frank Wenner, G. W. Nusbaum, and B. C. Cruickshanks. 10 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper 227 of the Bureau of Standards.

This paper contains the results of an investigation of the electrical conductivity of Dardelet threads and of the American National coarse threads on 3/4-inch bolts and nuts, made from both ferrous and non-ferrous metals. Those interested in this subject can obtain copies of the pamphlet from the Dardelet Threadlock Corporation, 120 Broadway, New York City.

MECHANICAL WORLD YEAR BOOK (1931). 358 pages, 4 by 6 inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 1/6, net.

Several improvements and new sections have been introduced into the 1931 edition of this well-known little handbook of mechanical engineering. The sections on steam boilers, internal combustion engines, belt conveyors, hydraulics. and gearing have been rewritten and enlarged. An attempt has been made to eliminate the lengthy calculations frequently involved in the design of power plant equipment and to present in a concise form information required in workshop practice. The book contains the usual classified buyers' directory in four languages—English, French, Spanish, and German.

TABLES OF CHEMICAL COMPOSITIONS, PHYSICAL AND MECHANICAL PROPERTIES, AND CORROSION-RESISTANT PROPERTIES OF CORROSION-RESISTANT ALLOYS. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price, $1.50.

This book comprises a collection of tables containing data on corrosion-resisting and heat-resisting alloys. The range of materials includes chromium, chromium-nickel, and other special steels, nickel and high-nickel alloys, brasses and bronzes and other copper alloys, aluminum alloys, etc. The tables are reprinted from the Proceedings of the Society, and are distributed in a special binder for convenient reference.

ELECTRIC ARC WELDING. 80 pages, 4 1/4 by 7 inches. Published by the Hobart Bros. Co., Troy, Ohio. Price, $1.

This manual on electric arc welding aims to present such facts about the process as are essential to its successful application in practical work. An effort has been made to avoid highly technical and theoretical discussion and confine the work to useful, non-technical information based on practical experience. The book contains nine chapters dealing with the welding arc, welding equipment, types of joints and welds, weldability of metals, choice of electrodes, using the metallic arc, using the carbon arc, operating instruction for Hobart "Constant Arc" welders, and speed and cost of arc welding. Three supplementary sections are included, showing examples of arc welding and types of Hobart "Constant Arc" welders.

THE ROMANCE OF ANTI-FRICTION. By Winfield S. Rogers, in collaboration with Nellie S. Rogers. 80 pages, 5 by 7 1/2 inches; numerous illustrations. Published by W. S. Rogers, South Orange, N. J.

The author of this book was a pioneer in the ball and roller bearing field, and for many years was president of the Bantam Ball Bearing Co. The book traces the history of ball and roller bearings in this country back to 1898, and refers to many of the early happenings in the industry. It then briefly sketches the development of the industry up to the present time. Among the interesting chapters in the book may be mentioned a reprint of an article written by Mr. Rogers in the *Engineering Magazine* in January, 1907, in which he examined critically the types of ball bearings made up to that time, and pointed out the advantages and disadvantages of different types.

MECHANICAL WORLD ELECTRICAL POCKET BOOK (1931). 332 pages, 4 by 6 inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 1/6, net.

This is the twenty-fourth edition of a little handbook containing a collection of electrical engineering notes, rules, tables, and other data. Some of the new material in the present edition relates to the operation and maintenance of heavy electrical engineering equipment, such as power plant and electric traction equipment. The sections on lighting circuits and switching have been entirely revised, and those on lamps and lighting have been expanded and brought up to date. Material has been added on direct-current generators, direct-current motors, synchronous motors, induction motors, auto-synchronous motors, synchronous-induction motors, and traction motors.

A. S. T. M. STANDARDS. Published in two volumes. Part I (dealing with metals), 1000 pages, 6 by 9 inches; Part II (dealing with non-metallic materials), 1214 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price: Cloth, Part I, $7.50; Part II, $7.50; both parts, $14; half-leather, Part I, $9; Part II, $9; both parts, $17.

The 1930 Book of Standards contains about 430 standard specifications, methods of testing, definitions of terms, and recommended practices covering metals and non-metallic materials. This book of standards is issued triennially. The standards adopted in the intervening years are published in supplements to the book of A. S. T. M. Standards. Before a standard receives the formal approval of this Society, it is published for one or more years as a tentative standard.

ECONOMIC CONTROL OF ENGINEERING AND MANUFACTURING. By Frank L. Eidmann. 402 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York. Price, $4.

The purpose of this book is to point out the problems of engineering and manufacturing whose solution depends upon economic analysis, and to present methods of procedure for the industrial engineer. The book covers modern management, financial calculations, economic considerations in plant location, engineering for manufacture, the engineering estimate, selection and economical use of materials and equipment, materials handling, planning for production, standardization and simplification, industrial research, packing and shipping the product, marketing policies, economics of the power plant, personnel work, and wage-payment plans. Many examples drawn from actual practice are given to illustrate the principles set forth.

HIGH-SPEED STEEL. By M. A. Grossmann and Edgar C. Bain. 178 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $3.50.

In this book, the authors have attempted to present a general view of the manufacture and properties of high-speed steel. The survey is intended to show how the behavior of high-speed steel in manufacture and final preparation is governed by general laws. The book is divided into two parts; the material in Part I is a record of what the authors regard as good practice, particularly in the hammering and rolling of ingots and bars, in heating operations during fabrication, and in the preparation and heat-treatment of finished tools. Part II is an account of fundamental physical properties. It contains constitution diagrams and shows micro-structures developed under various conditions of manufacture and heat-treatment. Information is also given on the magnetic properties, chemical constitution, and shrinkage behavior of high-speed steel.

NEW CATALOGUES AND CIRCULARS

CRANE CHAINS. Newhall Chain Forge & Iron Co., 9-15 Park Place, New York City. Card illustrating various styles of heavy-duty crane chains.

ELECTRIC FANS. Century Electric Co., 1806 Pine St., St. Louis, Mo. Bulletin 41, descriptive of the line of Century alternating- and direct-current fans.

TRUCKS. Crescent Truck Co., Lebanon, Pa. Circular entitled "Built Rugged for Service," showing various types of Crescent trucks engaged on different classes of work.